GLOBAL WARMING, CHALLENGES & OPPORTUNITIES

AGRASAR LECTURE SERIES

WOMEN & CHILD WELFARE SOCIETY

RASTRIYA VIGYAN PRODYOGIKI EVAM SANCHAR PARISHAD

PUBLICITY MATERIALS

GLOBAL CLIMATE CHANGE NEEDS GLOBAL ACTION NOW

Agrasar Lecture & Demostration programme on "Climate Change, Challenges & Opportunities"

Published By

WOMEN & CHILD WELFARE SOCIETY

Gamhandia New Colony, Buxibazar, Cuttack

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Rastriya Vigyan Evam Prodyogiki Sanchar Parishad (RVPSP), Department of Science & Technology (DST), New Delhi

The microclimate describes climates of small areas of vegetation, forests.

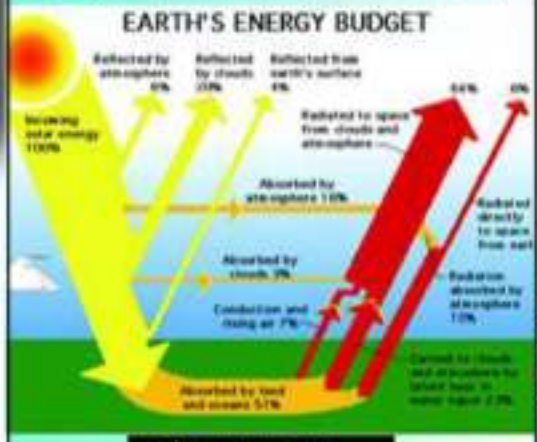
Meso-climate concerns landscape and terrains.

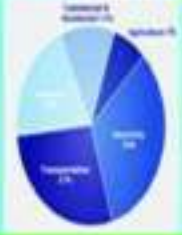
acro or global climate encompasses continental
d Global interrelationships. Relatively large areas
ve similar climate properties. These areas are
t together to form climatic zones.

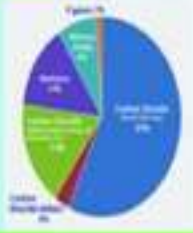
Earth formed ~4.6 billion years ago, originally very hot.

Sun's energy output only 70% of present.

uid water present ~ 4.3 billion years ago (zircon dating).
e appeared ~3.8 billion years ago
tosynthesis began 3.5-2.5 billion years ago
duced oxygen and removed carbon dioxide
rth went through periods of cooling ("Snowball Earth") and warming
rth began cycles of glacial and interglacial periods ~3 million years ago



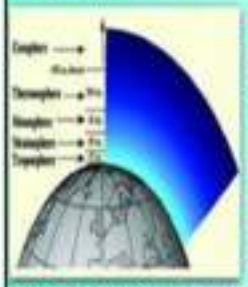




- Global Warming is the Climate change due to rise in temperature in the lower atmosphere by absorption of long wave length infrared radiations by different Green-house Gases (GHG) and they retain heat.
- Most Greenhouse Gases occur naturally in the atmosphere, while others result from human activities.

Major GHGs are:-

1) Carbon dioxide (CO_2)
2) Methane (CH_4)
3) Nitrous Oxide (N_2O)
4) Fluorinated Compounds
5) Hydrofluorocarbons (HFCs)
6) Perfluorocarbons (PFCs)
7) Chlorofluorocarbons (CFCs)
8) Water Vapor
9) Ozone etc.



Stratospheric Ozone (Good Ozone):
Holds 90% of Atmospheric Ozone.
Beneficial Role: Acts as Primary UV Radiation Shield.

Troposphere Ozone (Bad Ozone):
Holds 10% of Atmospheric Ozone.
Harmful Impact: Toxic Effects on Humans and Plants.

Good Ozone: Stratospheric ozone acts as a shield to protect the Earth's surface from the sun's harmful ultraviolet radiation, and also plays a crucial role in governing the stratospheric thermal structure.
Bad Ozone: In the troposphere, the air we breathe, ozone is a harmful pollutant that causes damage to plants and harms humans' health.

Global warming is the rise in temperature of the Earth's atmosphere. The atmosphere's made up of layers of gases - some of which are called greenhouse gases those make up a kind of 'thermal blanket over the Earth.

Rays

This lets some of the rays back out of the atmosphere, keeping the earth at the right temperature for animals, plants and humans to survive (60°F/16°C).

So some think global warming is good.

Methane and ozone trap more heat per molecule but have less effect on climate change. Carbon dioxide is behind water vapor.

Fossil fuel, deforestation and industrial production are main sources. Humans emit around 32 gigatons of CO_2 per year.

Half of this stays in the atmosphere; the rest is absorbed by oceans and vegetation. Increase recorded from 280 to 380 ppmv. Thus, future vegetation can't convert CO_2 to O_2 any more. Oceans saturate with CO_2. They too refuse further absorption.

Continued: Back Cover Inner Page

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EDITED BY:

SANGRAM KESHARI NAYAK

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PREFACE

It is a moment of great pride that RVPSP, Agrasar Lecture Series, Department of Science & Education, New Delhi considered our organization, Women & Child Welfare Society, Cuttack to conduct such an immensely satisfying programme; Agrasar Lecture Series on climate change issues to school students.

Recent attention to the threat of global environmental change has tended to focus on the possible impacts of a changing climate on food, ecosystems, agriculture, polity, economy, culture, biodiversity and conservation, renewable alternate energy to curtail fossil fuel consumption, water scarcity and many more implications those afflict and challenge our very existence. We had to carefully consider subjects on priority basis those are most appropriate to school students who obviously yet innocently approach towards manifold adversities more than anybody else. From a policy viewpoint, however, it was also critical to understand the degree of perception of these students to which human related activities is contributing to global-scale environmental change and the extent to which we can still prevent, mitigate, or adapt to climate change mainly affecting our life habitats, agriculture and hunger. These three issues are likely to become especially important in making decisions not only about how to reduce the magnitude of human perturbations to the environment but also about how to improve both food security and environmental quality in the more crowded world of the future.

It was gratifying that a group of dedicated scientists, environment activists, and subject matter specialists recorded their heartfelt willingness to impart lectures even though they had to endure difficult journey to reach remotely located schools across the coastal areas of Kendrapada and Jagatsignhpur district and other institutions. I must record their spirit, enthusiasm and rare gesture to educate the most deserving audience - the students.

The programme is designed for educators and community activists to provide state of art information to students of 20 selected schools as well as providing tips on 1) implementing a school-wide energy efficiency program 2) solid ideas on how to involve students in saving energy in their school; and 3) laying hands and playing games on energy-saving. The lesson plans are fun and skillfully executed.

Each of the lectures is followed by many a valuable suggestions on how to mitigate or adapt better to specific adversities. These are intended to be inculcated by the teachers and students as well. In general, it is time to evolve cost-effective policies and initiatives including those that promote renewable energy, energy efficiency, and related clean technologies. Offering guidance, and outreach support for awareness campaigns, promoting nature study camps more particularly for the students of schools. It is rightfully and timely supported and catalyzed by Rastriya Vigyan Ebam Prodyogika Sanchar Parishad, DST, Govt. of India, New Delhi. We are extremely thankful for considering our organization as a an able vector to disseminate the objectives.

Sangram Keshari Nayak
Editor & Principal Investigator

Minati Bindhani
General Secretary, WCWS

CONTENTS

GLOBAL WARMING, CHALLENGES & OPPORTUNITIES	Sangram Keshari Nayak	05
ROLE OF RENEWABLE ENERGY IN CONTEXT OF GLOBAL WARMING	Panchanan Tripathy	14
CLIMATE CHANGE IS ONE OF THE GREATEST ENVIRONMENTAL ISSUES OF OUR TIME	Prof. Sanjay K. Samantaral	18
HAZARDS UNDER EXTREME WEATHER CONDITIONS & THEIR RELEVANT MITIGATIONS	Bikash Mohapatra	20
CLIMATE CHANGE IMPACT ON BIODIVERSITY OF ODISHA	Kishore Chandra Mohanty	24
HOW PROTECTIVE IS OZONE TO CLIMATE CHANGE THREAT	Abhisek Sasmal	28
SOIL BIOLOGICAL HEALTH & ITS FERTILITY PROPERTIES	Dr. Mirja Jaynul Baig	32
BIODIVERSITY AND ITS CONSERVATION	Dr. Sudarsan Sasmal	37
DROUGHT AND CLIMATE CHANGE	Dr. Padmini Swain	42
CONSERVATION OF FISH BIODIVERSITY	S S Jiban Dash & Rajashree Nanda	48
WATER SCARCITY AND GLOBAL WARMING	Sangram Keshari Nayak	56
DISTURBING FACTS ON CLIMATE CHANGE	Swayam Prakash Baral	60

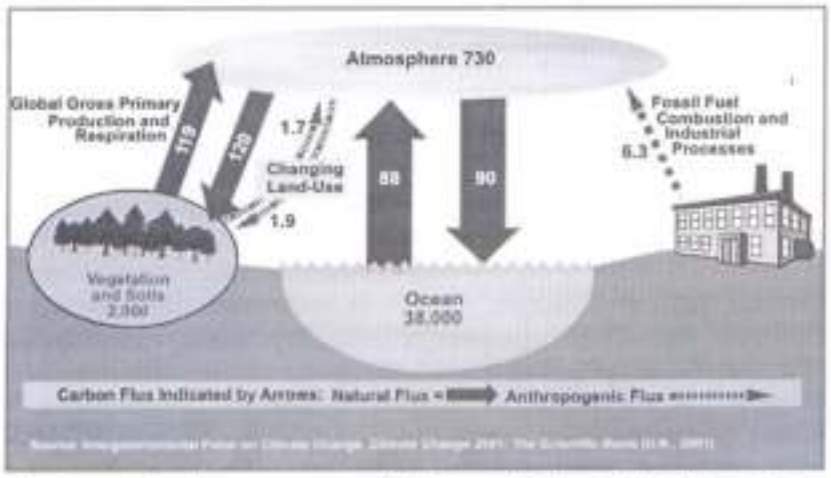
GLOBAL WARMING, CHALLENGES & OPPORTUNITIES

Sangram Keshari Nayak
Former Principal Scientist & Head
Central Rice Research Institute, Cuttack

Environmental awareness has created a focused timeline since the start of this new millennium. Climate change is often interchanged with the words 'global warming'. The two are distinctly different. If you combine the two, you get this: Global warming is human-induced climate change. Global warming is the accelerated warming of Earth due to an increase in greenhouse gases, particularly from the burning of fossil fuels. Evidence for global warming can be seen in retreating ice caps, dry lakes, increased habitat reduction for animals, global temperature rises, shifts in weather, coral bleaching, sea-level rise and more. Global warming is the human-induced rise in global temperatures. Climate change is the natural change in global temperatures over time. More specifically, a change in Earth's energy budget can result in both increases and decreases in global temperatures. Climate change occurs with natural spontaneity. Long before humans were in the picture, climates have changed both regionally and globally. The microclimate describes climates of small areas of vegetation, forests. Mesoclimate concerns landscape and terrains. Macro or global climate encompasses continental and global interrelationships. Relatively large areas have similar climate properties.

Global carbon cycle and climate change

Life processes are fuelled by carbon compounds which are oxidized to CO2 (carbon dioxide), the latter is exhaled by all animals and plants. Conversely, CO_2 is assimilated by plants during photosynthesis to build new carbon compounds. CO_2 is produced by the burning of fossil fuels, which derive from the preserved products of ancient photosynthesis. The atmosphere exchanges CO2 continuously with the oceans. Regions or processes that predominantly produce CO2 are called sources of atmospheric CO2, while those that absorb CO2 are called sinks.



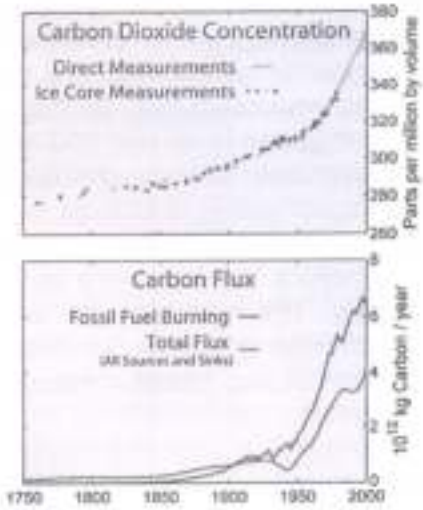
The graph shows the annual carbon flow and storage in billion metric tons (Source: Earth System Res.Lab.:2007)

While CO_2 is only a very small part of the atmosphere (0.04%), it plays an important role in the energy balance of our planet: CO_2 in the atmosphere acts like a blanket over the planet by trapping long-wave radiation, which would otherwise radiate heat away from the planet (greenhouse effect). As the amount of CO_2 increases, so will its warming effect. CO_2 is the largest contributor (currently 63%) to this effect by long-lived gases and its role increases each year. The additional burden of CO_2 in the atmosphere will remain

for a very long time, of the order of thousands of years, if we have to rely on the natural mechanisms of erosion and sedimentation to process the added CO_2.

Composition of Air:
Normal atmospheric air is composed of Nitrogen (N_2) 78.084 %; Oxygen (O_2) 20.9476 %, Argon (Ar) 0.934 %; Carbon Dioxide (CO_2) 0.0314 %; Neon (Ne) 0.001818 %; Methane (CH_4) 0.0002 %; Helium (He) 0.000524 %; Krypton (Kr) 0.000114 %; Hydrogen (H_2) 0.00005 % and Xenon (Xe) 0.0000087 %.

In terms of contribution and order, the most abundant greenhouse gases (GHG) in Earth's atmosphere are water vapour (36-72%), carbon dioxide (9-26%), Methane (4-9%), Ozone (3-7%) along with nitrous oxide and chlorofluorocarbons. Figures in parenthesis indicate individual contribution of each GHG. Carbon dioxide has increased from pre-industrial 280 ppm to 380 ppm of current level, Methane from 772 ppb to 1745 ppb, Nitrous oxide from 270 ppb to 314 ppb and CFC-12 from 0 to 533 ppb.



Now, evidences say that water vapour constitutes 2% of atmosphere and accounts for the largest percentage of the greenhouse effect, between 36% and 66% for clear sky conditions and between 66% and 85% when including clouds.

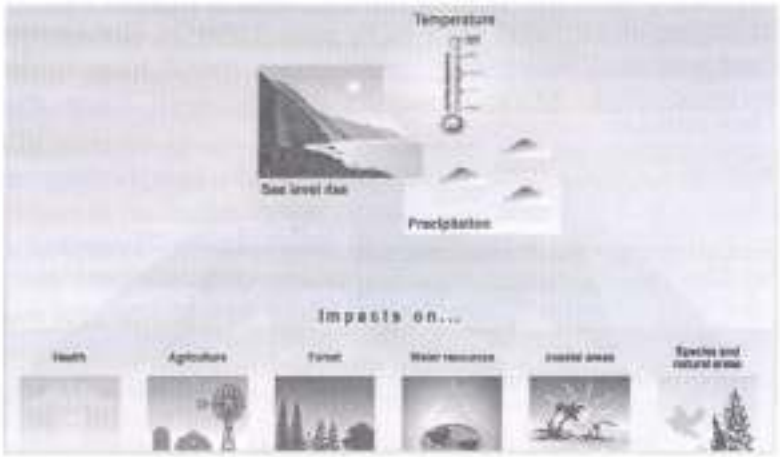
Over the 1900-2005 period, the USA was the world's largest cumulative emitter of energy-related CO_2 emissions, and accounted for 30% of total cumulative emissions (IEA, 2007). The second largest emitter was the European Union, at 23%; the third largest was China at 8%; fourth was Japan at 4%; fifth was India, at 2%. The rest of the world accounted for 33% of global, cumulative, energy-related CO_2 emissions. Today, the stock of carbon in the atmosphere increases by more than 3 million tonnes per annum (0.04%) compared with the existing stock. It seems less, but year after year is enormous cumulative. This increase is the result of human activities by burning fossil fuels, deforestation and forest degradation in tropical and boreal.

Ozone, an allotropic form of the chemical element oxygen. Ozone is triatomic oxygen, O3, and has a molecular weight of 47.9982 atomic mass units (amu). It is the most chemically active form of oxygen. It is formed in the ozone layer of the stratosphere by the action of solar ultraviolet light on oxygen. Ozone is important because its formation prevents most ultraviolet and other high-energy radiation, which is harmful to life, from penetrating to the earth's surface. Increased CO_2 levels cause warming in the troposphere but cooling in the stratosphere and mesosphere.

Methane and ozone trap more heat per molecule but have less effect on climate change. Carbon dioxide is behind water vapor. Half of this stays in the atmosphere; the rest is absorbed by oceans and vegetation. At this rate of increase, future vegetation may refuse to convert CO2 to O2 any more. Oceans now saturate with CO2. They too refuse further absorption of CO_2. Human activities like industrialization

contributes 24%, deforestation 20%, Vehicles 17%, Oil & Gas 17%, Fertilizer (N20) 6%, Belching of methane from animals 5.1%, Cement industry 4%, Aviation 3.5%, Garbage 3% and others 3.2 % to the carbon foot prints of the earth's atmosphere.

Climate change impact:



Glacial retreat: IPCC (2007) found that, on average, mountain glaciers and snow cover had decreased in both the northern and southern hemispheres. This widespread decrease in glaciers and ice caps has contributed to observed sea level rise. Their predictions are mountainous areas in Europe will face glacier retreat, in Latin America, changes in precipitation patterns and the disappearance of glaciers will significantly affect water availability for human consumption, agriculture, and energy production. In Polar regions, there will be reductions in glacier extent and the thickness of glaciers. Himalayan Glaciers will shrink from 500,000 Sq km to 100,000 Sq km. Winter rains will decrease (December, January and February), Implying lesser storage and greater water stress. Estimated Sea level rise by 40 cm higher than today's level by the end of 21st century. It will flood the coastal areas in India and affect 2.4 billion people as environmental refugees. Ganges, Indus, Brahmaputra, Mekong, Salwen and Yellow could diminish as temperatures rise. China, Pakistan, Bangladesh, Nepal and Myamar could experience floods followed by droughts in coming decades. In India alone, the Ganges provides water for drinking and farming for more than 500 million people.

Oceans : The oceans serve as a sink for carbon dioxide, taking up much that would otherwise remain in the atmosphere, but increased levels of CO_2 have led to ocean acidification. Furthermore, as the temperature of the oceans increases, they become less able to absorb excess CO_2 and obviously increase in volume resulting in high sea level rise. Global warming is projected to have a number of effects on the oceans.

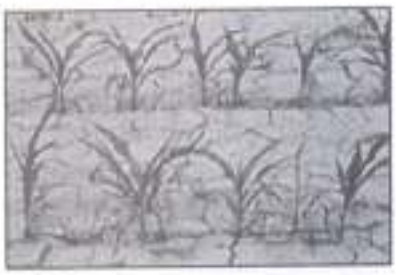
Sea ice & water level rise : As the climate warms, snow cover and sea ice extent decrease in both the Arctic and Antarctic. Some models projected that summer sea ice cover in the Arctic would disappear entirely by the latter part of the 21st century. IPCC (2007) reported that since 1961, global average sea level had risen at an average rate of 1.8 [1.3 to 2.3] mm/yr. Across the six SRES marker scenarios, sea level was projected to rise by 18 to 59 cm (7.1 to 23.2 inches) by 2008 and is currently rising at about 4 mm (0.16 in) per year.

Ocean Temperature rise: From 1961 to 2003, the global ocean temperature has risen by 0.10 °C from the surface to a depth of 700 m. There is variability both year-to-year and over longer time scales, with global ocean heat content observations showing high rates of warming for 1991 to 2003, but some cooling from 2003 to 2007.

Ocean Acidification: Ocean acidification is an effect of rising concentrations of CO_2 in the atmosphere, and is not a direct consequence of global warming. The oceans soak up much of the CO_2 produced by living organisms, either as dissolved gas, or in the skeletons of tiny marine creatures that fall to the bottom to become chalk or limestone. Oceans currently absorb about one tonne of CO_2 per person per year. It is estimated that the oceans have absorbed around half of all CO_2 generated by human activities since 1800 (118 ± 19 petagrams of carbon from 1800 to 1994). There are concerns that increasing acidification could have a particularly detrimental effect on corals (16% of the world's coral reefs have died from bleaching effect).

Water Quality and Quantity. Human health depends on an adequate supply of potable water. By reducing fresh water supplies, climate change may affect sanitation and lower the efficiency of local sewer systems, leading to increased concentrations of pathogens in raw water supplies. Flooding is likely to become more frequent with climate change and can affect health through the spread of disease. No sanitation technology is "safe" when covered by flood waters, as fecal matter mixes with flood waters and is spread wherever the flood waters go.

Food Security. The IPCC has reviewed the results of many modeling experiments that project future changes in crop yields under climate change. Climate change may increase yields of cereal grains at high and mid-latitudes but may decrease yields at lower latitudes. The world's food system may be able to accommodate such regional variations at the global level, with production levels, prices, and the risk of hunger being relatively unaffected by the additional stress of climate change.



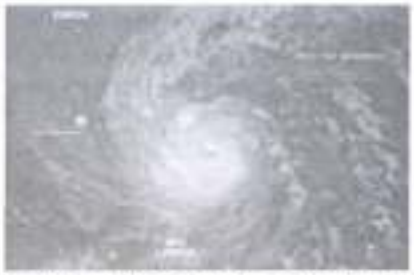
Heat Waves and Milder Winters. Heat stress is a direct result of exposure to high temperatures. Stressful hot weather episodes (heat waves) cause deaths in the elderly, as well as heat related illnesses such as heat stroke and heat exhaustion.

Air Pollution. The air is full of particles and gases that may affect human health, such as pollen, fungal spores, and pollutants from fossil fuel emissions. Weather conditions influence air pollution via pollutant (or pollutant precursor) transport and/or formation. Exposures to air pollutants have serious public health consequences. Climate change, by changing pollen production, may affect timing and duration of seasonal allergies.

Infectious Diseases. Vector-borne diseases are transmitted by insects (e.g., mosquitoes) and ticks that are sensitive to temperature, humidity, and rainfall. Climate change may alter the distribution of important vector species, and this may increase the risk of introducing disease into new areas. Malaria, Dengue Fever, Asian Tiger, Diarrhea, Lyme disease, tick-borne encephalitis, sandflies will increase beyond proportion as the vectors can better survive under climate change.

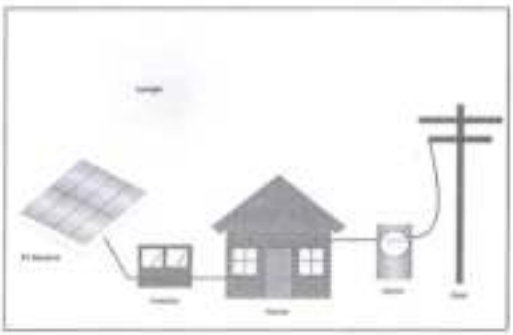
Natural Disasters. Climate change will increase the risk of both floods and droughts. Ninety percent of disaster victims worldwide live in developing countries, where poverty and population pressures force growing numbers of people to live on flood plains and on unstable hillsides. The vulnerability of those living in risk-prone areas is perhaps the single most important cause of disaster casualties and damage.

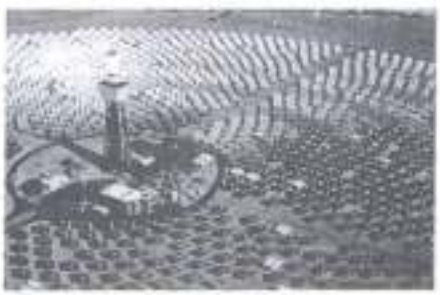
Cyclones, Tornados, Tsunamis, Katrina calamities: A tsunami is a huge ocean wave that can travel at speeds up to 600 mi/hr (965 km/hr), hundreds of miles over open sea before it hits land. Sometimes incorrectly called a tidal wave, a tsunami is usually caused by an under sea earthquake, volcanic eruption and coastal landslide. The recent Tsunami of Japan is the worst disaster that has claimed more than 20,000 human lives by the time this article was written (15 Mar.,2011). Tsunami is Japanese for "harbor wave." It is, in fact, a series of waves which travel outward on the ocean surface in all directions in a kind of ripple effect. It can even hit the nuclear plants and its radiation effect could be unimaginable. In 2004, the Tsunami in Indian ocean killed more than 200,000 people in Indonesia, Sri Lanka, Thailand, India and as far away as the African countries of Somalia and Madagascar.



Climate change mitigation options: Mitigation is distinguished from adaptation to global warming, which involves acting to tolerate the effects of global warming. Most often, it involves reductions in the concentrations of greenhouse gases, either by reducing their sources or by increasing their sinks. Examples include using fossil fuels more efficiently for industrial processes or electricity generation, switching to renewable energy (solar energy or wind power), improving the insulation of buildings, and expanding forests and other "sinks" to remove greater amounts of carbon dioxide from the atmosphere.

Renewable Energy: A **solar cell** (also called **photovoltaic cell** or **photoelectric cell**) is a solid state device that converts the energy of sunlight directly into electricity by the photovoltaic effect. Assemblies of cells are used to make solar modules, also known as *solar panels*. The energy generated from these solar modules, referred to as *solar power*, is an example of *solar energy*. **Organic solar cells** are a relatively novel technology, yet hold the promise of a substantial price reduction (over thin-film silicon) and a faster return on investment. These cells can be processed from solution, hence the possibility of a simple roll-to-roll printing process, leading to inexpensive, large scale production.



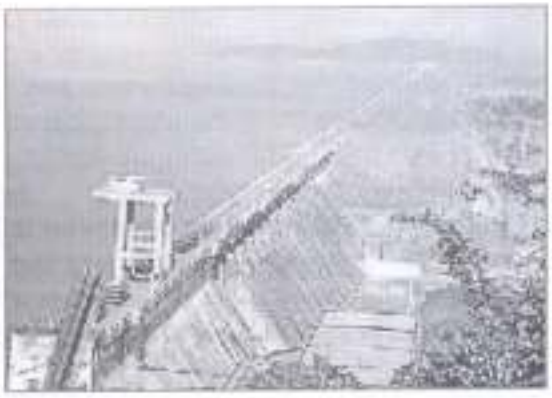


Solar Power Plant: Photo on right is a view of a solar thermal power plant with California

utilities expanding rapidly into renewables, the Mojave Desert is one of the hottest spots for solar energy. The $2 to $3 billion dollar deal provides options for additional plants (up to 900 megawatts total), which would be enough to power 375,000 Californian homes.

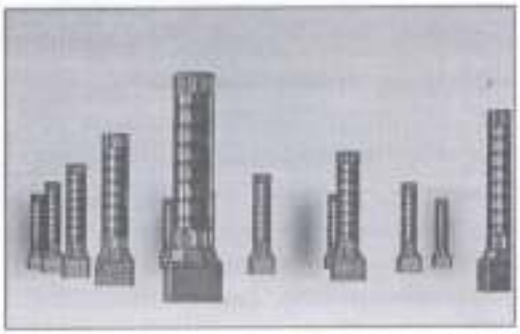
Wind Power: Wind power has been used for centuries.The extraction of wind energy and conversion into a useful type of energy: thermal, mechanical, or electrical. The nature has given enough wind energy but we can harvest maximum of 60% through wind machines. Practical machines actually extract from 5 to 45% of the available power. Most research on wind power has been concerned with producing electricity. Wind power is a renewable energy source that has virtually no environmental problems. However, wind power has limitations. Wind machines are expensive and can be located only where there is adequate wind. It has a main disadvantage that occurs because the demand for electricity varies with time, and electricity production must follow the demand cycle. Since wind power varies randomly, it may not be available when needed. The storage of electrical energy is difficult and expensive. India is the world's third largest wind turbine manufacturer. Suzlon has now mastered the process of manufacturing, designing, installation, power evacuation and maintenance of the wind farm and has considerably streamlined the process of wind farm installation especially for the private players.

Hydro Electricity: Hydroelectric power is by far the most important source of renewable energy worldwide. Hydroelectric power is generated in areas that have the right sort of topography. Mountainous regions are often appropriate, because they allow for the formation of large, deep reservoirs, such that the retained water accumulates a great deal of gravitational potential energy. Naturally the large, powerful rivers of great continents have more potential for the generation of electricity. High voltage wires allow for the relatively efficient transmission of electricity over long distances. At present China's hydroelectric capacity is greater than that of any other country like Canada, USA or Russia.



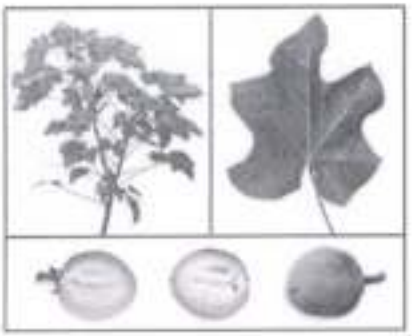
Wave Power: Waves are generated by wind passing over the surface of the sea. Wave height is determined by wind and in general, larger waves are more powerful but wave power is also determined by wave speed, wavelength, and water density. Oscillatory motion is the trick to capture energy and convert t electrivity which is

highest at the surface and diminishes exponentially with depth. Picture shows a model wave energy generator floating on the waters near Limfjorden, Denmark. A full-scale version of this prototype will be placed in the North Sea. It uses wave power to create electric energy. Earlier experiments with wave power, however, faced problems in rough seas. It is great to know that two drop out students of Barang High School, Cuttack demonstrated electricity generation from wave energy at Puri sea beach.



Carbon sequestration: Another option is taking carbon dioxide straight out of the air and storing it. Carbon sequestration is a hot research field that owes its latest popularity to the upswing in global attention directed towards global warming. The phrase carbon sequestration" refers to efforts to capture excess carbon dioxide from the atmosphere, condense it, and store it in some benign way. Carbon sequestration could be an important part of the fight against greenhouse gases.The "air capture" devices illustrated here were conceived by Columbia University researcher Klaus Lackner and Global Research Technologies LLC. Sometimes referred to as mechanical trees for their carbon-capturing function, these devices would - unlike trees - be able to work day and night and release the captured CO2 on demand. International bodies (including the UN) are already convinced about increasing forest cover as the best available option for sequestering CO2.

Biofuels: Renewable biofuels for transportation, such as ethanol and biodiesel, have contributed to a significant decline in oil consumption wherever biofuel is introduced successfully as an alternate to biodiesel or biopetrol. The 93 billion liters of biofuels produced worldwide in 2009 displaced the equivalent of an estimated 68 billion liters of gasoline, equal to about 5 percent of world gasoline production. Ethanol fuel is the most common biofuel worldwide, particularly in Brazil. Alcohol fuels are produced by fermentation of sugars derived from wheat, corn, sugar beets, sugar cane, molasses and any sugar or starch that alcoholic beverages can be made from (like potato and fruit waste, etc.). The ethanol production methods used are enzyme digestion (to release sugars from stored starches), fermentation of the sugars, distillation and drying. The distillation process requires significant energy input for heat (often unsustainable natural gas fossil fuel, but cellulosic biomass such as bagasse, the waste left after sugar cane is pressed to extract its juice, can also be used more sustainably).



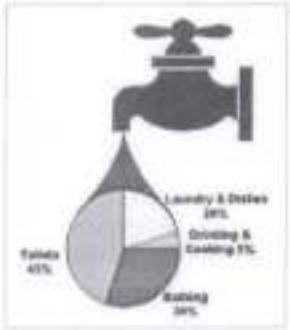
Climate change ...what we can do in our life style:

1. Plantation: Climate scientists believe that human-induced global deforestation is responsible for 18-25% of global climate change Trees

remove carbon dioxide from the air as they grow, tree planting can be used as a geoengineering technique to remove CO_2 from the atmosphere. Every nation and organization are encouraging reforestation, refrain from deforestation and other projects that encourage tree planting to mitigate the effects of climate change. It is targeted to achieve 100 Gigatonnes of carbon (cumulative) by 2050, equivalent to about 10% to 20% of projected fossil fuel emissions during that period. Ttropical forestation has a large net cooling effect, because of increased cloudiness and because of high tropical growth and carbon sequestration rates than in temperate regions. Plant a neem tree on the right corner of your house.

2. Cycling: Cycling is an extremely efficient mode of transportation optimal for short to moderate distances. Bicycles provide numerous benefits compared to motor vehicles, including exercise, an alternative to the use of fossil fuels, no air or noise pollution, much reduced traffic congestion, easier parking, greater maneuverability, and access to both roads and paths. The advantages are at less financial cost to the user as well as society with negligible damage to roads, and less pavement required.

3. Electric energy: Switch to CFL bulbs: Replace just one 100W bulb (incandescent lamp) with a 20W Compact Fluorescent Lamp (CFL) and that will reduce annual CO2 emissions by 84 kg and reduce annual electricity bills by '410 during its life time in comparison to incandescent bulbs and its heat is also much less. Switch off all lights and bulbs when not in use. Remove the connection of appliances from the switch board itself. It is roughly estimates that if every house Delhi alone would use CFL bulbs, 200,000,000 kg of CO2 will be consumed less per year. If just 1000 homes do that, that's 28000 kg of CO_2 less per year. Buy home appliances like fans, refrigerator, air conditioners etc with 5 eco-friendly green stars. Install Solar Heaters on roof tops. A single solar heater can reduce annual CO2 emissions by 687 kg and save annual electricity bills by` 3352. educe temperature economic yet ideal settings in Geysers, air conditioners, refrigerators etc.



4. Conserve Water: Nearly every human activity—from agriculture to transportation to daily living—relies on water resources and affects the availability and quality of those resources. Conserve just 100 litres per household per day through various measures. Reduce annual CO_2 emissions by 24 - 63 kg. Harvest 1000 litres of rainwater every day over 40 days of rainfall. Reduce annual CO2 emissions by 27 to 70 kg. Worldwide, nearly 4000 km^3 of water is withdrawn every year from surface and ground waters. This is a sixfold increase from the levels withdrawn in 1900 (since which time population has increased four times). improvements can be achieved by changing industrial and agricultural practices. Agricultural water consumption has an estimated overall water use efficiency of 40% but it is the maximum for all developing

countries (India >75%). More judicious use like drip irrigation, sprinkler irrigation are being practiced in agriculture, horticulture and other water intensive usages.

4. **Eat organics:** Organic agriculture is the science and art of growing fruits, vegetables, flowers, or ornamental plants and edible staple crops (cereals like rice, wheat etc) by following the essential principles of organic agriculture in soil building and conservation, pest management, and biodiversity preservation. Biopesticides are used in place of highly poisonous synthetic chemicals that saves health and environment.

Sharing the Responsibility: One of the aspects of mitigation is to share the costs and benefits of mitigation policies and their implementation. There is no scientific consensus over how to share these costs and benefits with equitability among developed countries taking the load more than the developing countries (KYOTO Protocl, 2005). In terms of the politics of mitigation, the UNFCCC's ultimate objective is to stabilize concentrations of GHG in the atmosphere at a level that would prevent "dangerous" climate change. There is, however, no widespread agreement on how to define "dangerous" climate change.

Some of the priority areas are to check global population increase, alternative propulsion, avoiding dangerous climate change, use biochar, adapt low carbon diet, climate bond and C footprint tax, afforestation, GHG Emissions restrictions and Zero Carbon economy, green IT, high water use efficiency, Bio-fuel and present fossil fuel phase out, overpopulation, stratospheric sulfur aerosols (geoengineering) etc are some of the promising areas to retreat to pre-industrial C budget and ensure harmony of living being with nature endowed with same historical biodiversity and prosperity.

Significant alterations to the biophysical environment due to future changes to the climate may require adaptations to patterns of life style management. Changes may be required to cope with both an increased incidence of extreme weather events and change in long-term mean conditions. Current management systems may have a certain limit as to how much they can adapt before it is necessary for more radical yet befitting changes. Management systems adaptation to mitigate the impacts of Climate Change is, however, considered the most likely. It can be argued that decision-making in terms of change is best studied in an integrated manner as it holistically addresses various feasible interface between biophysical processes and human interventions. We must plan to power 100 % of the planet with renewable energy.

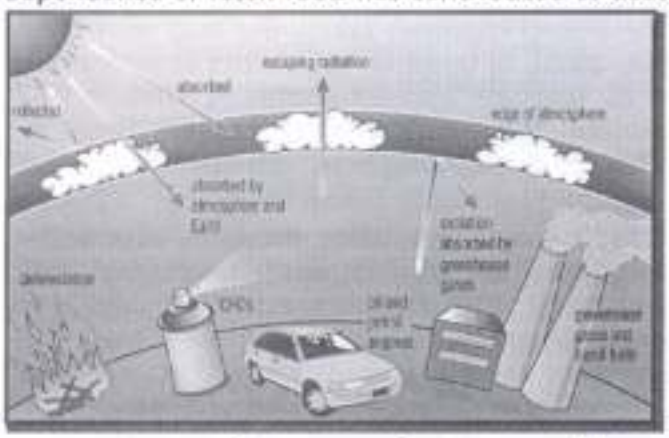
The author is the Principal Invetigator, Project "Agrasar Lecture Series" funded and catalyzed by RVPSP, DST, New Delhi and organized by Women & Child Welfare Society, Cuttack. The organization is dedicated to the awareness and front-line advocacy on climate change issues and relevant remedial.

ROLE OF RENEWABLE ENERGY IN CONTEXT OF GLOBAL WARMING

Panchanan Tripathy
Asst. Director (Technical), OREDA Cell, DRDA, Cuttack

What is Green House Gas

Energy is a basic requirement for economic development. Every sector of world economic depends on agriculture, industries, transport, commercial and domestic need inputs energy. Our life demands higher use of energy by burring fossil fuels, which posses serious risks to global warming and to stability of earth's climates. Our dependence of fossil fuels has contributed to accommodation of GREEN HOUSE GASES.



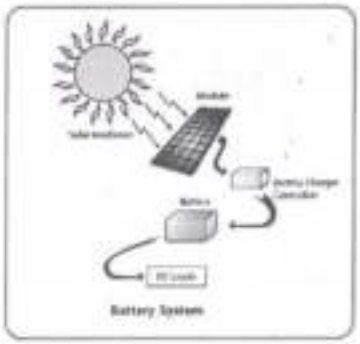
Green House Gases are Water vapour, carbon dioxide, nitrous oxide, Chloropflurocarbon (CFC), Ozone.

What is renewable Energy?

Renewable energy is energy which comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are renewable (naturally replenished). In 2008, about 19% of global final energy consumption came from renewables, with 13% coming from traditional biomass, which is mainly used for heating, and 3.2% from hydroelectricity. New renewables (small hydro, modern biomass, wind, solar, geothermal, and biofuels) accounted for another 2.7% and are growing very rapidly. The share of renewables in electricity generation is around 18%, with 15% of global electricity coming from hydroelectricity and 3% from new renewables.

Types of Renewable Energy: Sunlight, Wind, Rain, Tides and Geothermal Heat etc.

1) Solar Energy: Solar powered electrical generation relies on heat engines and photovoltaics. Solar energy's uses are limited only by human ingenuity. A partial list of solar applications includes space heating and cooling through solar architecture, potable water via distillation and disinfection, day lighting, solar hot water, solar cooking, and high temperature process heat for industrial purposes. To harvest the solar energy, the most common way is to use solar panels.



A) Solar Cooker: A solar oven or solar cooker is a device which uses sunlight as its energy source. Because they use no fuel and they cost nothing to run, humanitarian organizations are promoting their use worldwide to help slow deforestation and desertification, caused by using wood as fuel for cooking. Solar

Cookers are a form of outdoor cooking and are often used in situations where minimal fuel consumption is important, or the danger of accidental fires is high.

B) Solar Lantern: A Solar lantern is a simple application of solar photovoltaic technology, which has found good acceptance in rural regions where the power supply is irregular and scarce. Even in the urban areas people prefer a solar lantern as an alternative during power cuts because of its simple mechanism.

A solar Lantern is made of three main components - the solar PV panel, the storage battery and the lamp. The operation is very simple. The solar energy is converted to electrical energy by the SPV panel and stored in a sealed maintenance-free battery for later use during the night hours. A single charge can operate the lamp for about 4-5 hours.

C) Solar Street Lights: This system is designed for outdoor application in un-electrified remote rural areas. This system is an ideal application for campus and village street lighting. The system is provided with battery storage backup sufficient to operate the light for 10-11 hours daily. The system is provided with automatic ON/OFF time switch for dusk to down operation and overcharge / deep discharge prevention cut-off with LED indicators.

The solar street light system comprise of

- 74 Wp Solar PV Module
- 12 V, 75 Ah Tubular plate battery with battery box
- Charge Controller cum inverter (20-35 kHz)
- 11 Watt CFL Lamp with fixtures
- 4 metre mildsteel lamp post above ground level with weather proof paint and mounting hardware.

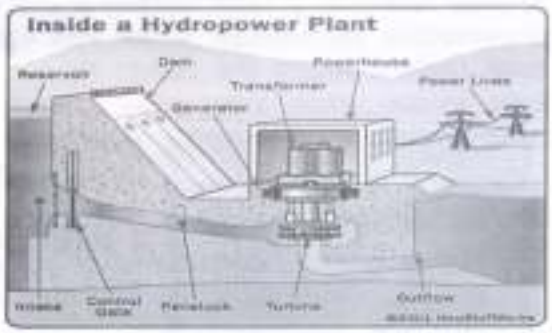
D) Solar water heater (SWH): systems comprise several innovations and many mature renewable energy (or SHW Solar Hot Water) technologies which have been accepted in most countries for many years. SWH has been widely used in Israel, Australia, Japan, Austria and China.

E) Solar Distillation System: A solar still is a low-tech way of distilling water, powered by the heat of the sun (more precisely, the heat & humidity of the soil, and relative cool of the plastic). Two basic types of solar stills are box, and pit. In a solar still, impure water is contained outside the collector, where it is evaporated by sunlight shining through clear plastic. The pure water vapor (and any other included volatile solvent) condenses on the cool inside plastic surface and drips down off of

the weighted low point, where it is collected and removed. The box type is more sophisticated.

2. Hydrolic Energy:

Micro hydro is a term used for hydroelectric power installations that typically produce up to 100 kW of power. These installations can provide power to an isolated home or small community, or are sometimes connected to electric power networks. There are many of these installations around the world, particularly in developing nations as they can provide an economical source of energy without purchase of fuel.



3. Bio Gas Plant:

The energy is generated through the process anaerobic degradation of organic waste. It is a cheap, appropriate and eco-friendly fuel. The process of generation of biogas has been an added benefit of a humus rich manner.

Technical specifications for comparison of Biogas Plants

1. 1.Cum Biogas plant can save 3.47 kilogram fire wood per day which comes to(3.47 x 365)=1267K.G fire wood per annuam x 800=10 Lakhs K.G or, one thousand(1000)trees.
2. 1.Cum Biogas plant can save 0.433 K.G.L.P.G per day which comes to 0.433 x365=158 K.G. or 168/12.5=12 numbers Cylinder Gas x 800=9600 Cylinder coal gas saved.
3. 1.Cum Biogas plant can save 0.62 Lt. Kerosene oil per day which comes to 0.62 x 365=226Ltrs per annuam(226 x 800)=one lakh Ltrs. per annuam.
4. 1.Cum Biogas plant can generate 4.7 kilowatt hour unit Electricity which comes to 4.7 x 365=1715 Kilowatt hour electricity per annuam 1715 x 800=13,72400 Kilowatt hour Electricity.
5. 1.Cum Biogas plant can produced 03 Ton or 3000 K.G. good quality manure that is 3 x 800=2400Ton on per annuam to supplement and optimize the use of Chemical fertilizers.
6. 1.Cum Biogas plant can save 02 Ton capacity of Carbon dioxide per annuam that is 2 x 800=1600 Toncapacity of Carbon dioxide which helps to reduce the global Warming

4. Biomass Gasifier:

It produces a combustible gas through the process of thermo-chemical conversion of waste woods and other agro byproducts. The gas is used in dual fuel engines for power generation/water pumping.

5. Wind Energy

A) **A windmill** is a machine which converts the energy of wind into rotational motion by means of adjustable vanes called sails. The main use is for a grinding mill powered by the wind, reducing a solid or coarse substance into pulp or minute grains, by crushing, grinding, or pressing.

B) **Wind Hybrid System:** It is mainly used to generate electricity directly from wind energy.

C) **Biofuel:** *Jatropha* is a genus of approximately 175 succulent plants, shrubs and trees (some are deciduous, like *Jatropha curcas*), from the family Euphorbiaceae. The generic name is derived from the Greek words *iatros* , meaning "physician," and *trophe*, meaning "nutrition," hence the common name physic nut. Mature plants produce separate male and female flowers. As with many members of the family Euphorbiaceae, *Jatropha* contains compounds that are highly toxic.

Bioethanol is an alcohol made by fermenting the sugar components of plant materials and it is made mostly from sugar and starch crops. With advanced technology being developed, cellulosic biomass, such as trees and grasses, are also used as feedstocks for ethanol production. Ethanol can be used as a fuel for vehicles in its pure form, but it is usually used as a gasoline additive to increase octane and improve vehicle emissions. Bioethanol is widely used in the USA and in Brazil. Biodiesel is made from vegetable oils, animal fats or recycled greases.

Climate change concerns, coupled with high oil prices, peak oil, and increasing government support, are driving increasing renewable energy legislation, incentives and commercialization. New government spending, regulation and policies helped the industry whether the global financial crisis better than many other sectors. Renewable energy resources are cleaner and far more abundant than fossil resources, but they tend to be dispersed and more expensive to collect. Many of them, such as wind and solar energy, are intermittent in nature, making energy storage or distributed production systems necessary. Therefore, the direct cost of renewable energy is generally higher than the direct cost of fossil fuels. At the same time, fossil fuels have significant indirect or external costs, such as pollution, acid rain, and global warming. Conventional forms of energy, such as fossil fuels and nuclear power, receive more financial support from the federal government than does renewable energy. However, a global transition to renewable energy will have to include developing nations, where energy use in proportion to the world total grew remarkably but of late.

CLIMATE CHANGE IS ONE OF THE GREATEST ENVIRONMENTAL ISSUES OF OUR TIME

Prof. Sanjay K. Samantarai
OUAT, Bhubaneswar

Climate change is one of the greatest environmental issues of our time and we need to act quickly to take advantage of existing solutions in order to prevent irreversible damage to our planet. Through careful nature studies, the important roles that ecosystems can play in mitigating and adapting to climate change impacts should be brought essentially in the agenda of learning at least for school students who are apprehensively more prone to climate risks. Natural ecosystems provide significant opportunities to cut emissions dramatically and to preserve the adaptive potential of our biosphere.

Our goal : Curbing emissions and adapting to change

We have to take initiatives to curb adverse effects of climate change. Each of our initiatives should illustrate the deep link between humanity and nature and must demonstrate the importance of an integrated approach to natural resource management.

Many factors are contributing to climate change, from fossil fuel use to the burning and clearing of tropical forests. We need a comprehensive approach to reduce the impacts of climate change - an approach that decreases emissions across all sectors and enhances the adaptive capacity of all nations.

Reducing greenhouse gas (GHG) emissions and stabilizing atmospheric concentrations at 350-450 parts per million CO_2 equivalent (ppm CO_2e) is essential. The current GHG level is approximately 390 ppm CO_2e. Scientists have estimated that lowering concentrations to 350 ppm may enable us to avert tipping points of ocean acidification and the melting of permafrost and arctic ice. Stabilization at 450 ppm is thought to be the threshold to avoid dangerous warming of more than 2 degrees Celsius, which would bring potentially catastrophic impacts for natural and human communities alike. We are already seeing changing weather patterns impacting food production and species migration. Fresh water scarcity risks becoming even more acute in drought-stricken countries and flooding may increasingly threaten our coastal communities and directly impact hundreds of thousands of people each year. Conflict is increasing over strained ecosystems and local communities are being forced from their homes.
Solutions are needed now. Our ecosystems must be able to adapt to these changes so that they can retain productivity, continue to buffer extreme weather events and provide fresh water and a myriad of other services for all life on Earth. In addition, human communities need the knowledge and tools to effectively adapt to the impacts of climate change.

Solution:

Protecting the Earth's ecosystems can yield immediate, cost-effective climate change solutions that will be forever lost if we do not take immediate action.

For example, the burning and clearing of tropical forests is a major - though often unrecognized - source of greenhouse gas emissions. It accounts for roughly 16 percent of total global emissions, more than all of the world's cars, trucks, ships, trains and planes combined. It is now generally recognized that it will be impossible to achieve any of the needed targets for mitigating climate change without significantly curbing the clearing and burning of tropical forests. In fact, reducing global deforestation by 50 percent by 2020 offers nearly one-third of the cost-effective, technologically available options to meet 450 ppm stabilization targets.

In addition, forests and other natural ecosystems - including wetlands, peat lands, coral reefs and mangroves - also reduce the risk of catastrophic impacts like floods and droughts, contribute to food and freshwater security for both rural and urban communities, allow for species migration and ecological adaptation, and support the livelihoods of indigenous and local communities. Maintaining these ecosystems will ensure that humans and other species can remain as resilient as possible to the impacts of climate change.

Strategic approach:

- Leading an effort to identify opportunities for effective mitigation and adaptation strategies in the places most sensitive to the impacts of climate change
- Working with partners on the ground - including local community governments, indigenous groups and civil society - to design pilot mitigation and adaptation projects
- Serving as a trusted advisor to the governments and stakeholders most in need of innovative policies and market mechanisms
- Ensuring climate mitigation and adaptation strategies are handled economically, effectively, equitably and transparently

Nature's Benefits in Action

Growing public awareness that the impact of natural disasters such as Hurricane Katrina or the 2004 Indian Ocean tsunami would have been lessened by healthier ecosystems (wetlands and mangroves, respectively) suggests an increased understanding of the insurance implications of option value. Although we cannot yet quantify the number of lives or value of infrastructure that might be spared by the storm-mitigating capacity of coastal ecosystems in the face of more frequent and extreme events predicted under climate change, they are likely to be realized in the foreseeable future.

A study performed by the Environmental Protection Agency (EPA) and the Gas Research Institute (GRI) in 1997 sought to discover whether the reduction in carbon dioxide emissions from increased natural gas (predominantly methane) use would be offset by a possible increased level of methane emissions from sources such as leaks and emissions. The study concluded that the reduction in emissions from increased natural gas use strongly outweighs the detrimental effects of increased methane emissions. Thus the increased use of natural gas in the place of other, fossil fuels can serve to lessen the emission of greenhouse gases in the country. Most mitigation proposals therefore imply an eventual reduction in global fossil fuel production but particularly in reducing carbon footprints.

HAZARDS UNDER EXTREME WEATHER CONDITIONS & THEIR RELEVANT MITIGATIONS

Bikash Mohapatra,
Secretary, SUPRATIVA

A disaster is the tragedy of a natural or human made hazard. Hazard is a situation that threats life, health, property, or environment. Disasters are normally the consequence of inappropriately managed risk. These risks are the product of hazards and vulnerability. Developing countries suffer the greatest costs when a disaster hits - more than 95 % of deaths occur in developing countries, and losses due to natural disasters are 20 times greater in developing countries than in industrialized countries.

- Natural Disasters: Volcanic eruption, earthquakes, floods, landslides, avalanches, cyclones, droughts, pests, forest fires, tsunami, tornados etc.,
- Human made disasters:
  A) Technological [engineering failures, transport accidents, environmental, nuclear etc.]
  B) Sociological: criminal acts, stampedes, riots, wars, terrorists, diseases HIV/AIDS, displacement - refugees etc.

During the last 300 years, about 3 million people died around the world due to natural disasters like earthquakes and volcanic eruptions. The Asia-Pacific region experiences nearly 60 per cent of the world's natural disasters. In India, out of the 30 states, 22 are disaster-prone. Fifty six per cent of the total geographical area of the country is under seismic threat. Orissa has rightly been called the disaster state capital of the country. It is highly vulnerable to natural disasters like sever cyclonic storms, floods, and draughts.

Orissa state has been declared disaster-affected for 95 of the last 105 years. While coastal districts of Orissa are exposed to floods & cyclones, western part of it is prone to the acute droughts.

Cyclones:
The Indian Meteorological Department (IMD) provides cyclone warnings from the Area Cyclone Warning Centres (ACWCs) at Calcutta, Chennai and Mumbai, and Cyclone Warning Centres (CWCs) at Bhubaneswar, Visakhapatnam and Ahmedabad. Cyclone warning is done in two stages: Issued 48 hours in advance and 24 hours in advance.

DOs & DONTs during CYCLONE:

Cyclones begin in tropical regions like northern Australia, South-East Asia and many Pacific islands. For a cyclone to develop, the sea surface must have a temperature of at least 26°C.

When warm air rises from the seas and condenses into clouds, massive amounts of heat are released. The result of this mixture of heat and moisture is often a collection of thunderstorms, from which a tropical storm can develop.

Before:

- Keep watch on weather and listen to radio or TV.
- Keep alert about the community warning systems.
- Know the nearest cyclone shelter / safe houses.
- Do not listen to rumors.

When the cyclone strikes:

- Disconnect all electrical appliances and turn off gas.
- Protect yourself with mattresses or blankets under a strong table or bench.
- If the wind suddenly drops, don't assume the cyclone is over.
- If driving, stop - but well away from the sea, trees, power lines etc.

After the cyclone:

- Listen to local radio for official warnings and advice.
- Do not go outside .
- Check for gas leaks. Do not use electric appliances, if wet.
- Be careful of snake bites and carry a stick or bamboo.
- Beware of fallen power lines, damaged bridges, buildings and trees.

Before FLOOD

- Know the safe route to nearest shelter house/ pucca house.
- Have an emergency kit and fast aid kit on hand.
- If your area is flood-prone, consider alternative building materials.
- You may consider making houses where the walls are made of local bricks up to the highest known flood level with cement pointing.

During Flood

- Drink boiled water.
- Keep your food covered, don't take heavy meals.
- Use raw tea, rice-water, tender coconut-water, etc. during diarrhea.
- Do not let children remain on empty stomach.
- Use bleaching powder and lime to disinfect the surrounding.

TSUNAMIS

Early detection:

- Deep-ocean Assessment and Reporting of Tsunamis (DART)
- Global Seismographic Network (GSN)
- Global Sea Level Observing System (GLOSS)
- the electronic box containing the SB Data Acquisition and Communication System (SB-DACS) relied on the same type of electronics of the UM
- comply

Tsunami Fact Sheet:

- Tsunamis striking the coastal locations are mostly caused by earthquakes.
- Some tsunamis can be very large with their height as great as 30 feet or more.
- All low-lying coastal areas can be struck by tsunamis.
- A tsunami consists of a series of waves.
- Tsunamis can travel up rivers and streams that lead to the ocean.
- Tsunamis can move faster than a person can run.
- The force of some tsunamis is enormous. Homes and other buildings are destroyed.
- All these materials and water move with great force and can kill or injure people.

Before & During Tsunami

- If a large undersea earthquake occurs near the coast, a local tsunami may follow.
- If you live in a tsunami zone and the ground shakes severely for more than one minute, head for high ground.
- If you are near the shore and see the water level rise or drop significantly. Move immediately to high ground.
- Turn on your radio to learn if there is a tsunami warning.
- Stay away from the beach. Never go down to the beach to watch a tsunami come in.
- If you are in school and you hear there is a tsunami warning, you should follow the advice of teachers.
- If you are at home and hear a tsunami warning, you should make sure your entire family is aware of the warning.
- If you are at the beach or near the ocean and you feel the earth shake, move immediately to higher ground.
- Stay away from rivers and streams that lead to the ocean as you would stay away from the beach and ocean.
- Tsunamis generated in distant locations will generally give people enough time to move.

- The upper floors of concrete building can provide a safe place.
- Do not stay in homes and small buildings located in low-lying coastal areas.
- Staying away from all low-lying areas is the safest advice when there is a tsunami warning.

HEAT WAVES:

Generally temperatures are 10 degrees or more above the average high temperature for the region during summer months, last for a long period of time and occur with high humidity as well. > 105 -110 ^{0}F. The heat index is the temperature the body feels when the effects of heat and humidity are combined. Exposure to direct sunlight can increase the heat index by 15°F.

Safety Tips:

- Avoid going out in the sun, especially between 12.00 noon and 3.00 p.m.
- Drink sufficient water, even if not thirsty.
- Wear lightweight, light-coloured, loose, and porous cotton clothes.
- Use protective goggles, umbrella/hat, shoes or chapals while going out in sun.
- Avoid strenuous activities when the outside temperature is high.
- While traveling, carry water with you.
- Avoid alcohol, tea, coffee and carbonated soft drinks, which dehydrates the body.
- Avoid high-protein food.
- If you work outside, use cap/umbrella .
- Use a damp cloth on your head, neck, face and limbs
- Do not leave children or pets in parked vehicles
- If you feel faint or ill, see a doctor immediately.
- Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc.
- Keep animals in shade and give them plenty of water to drink.
- Keep your home cool, use curtains, shutters or sunshade and open windows at night.
- Use fans, damp clothing and take bath in cold water frequently.

PREPAREDNESS FOR ANY UNWARRNTED DISASTER IS THE BEST OPTION.

The author is the Secretary,"SUPRATIVA" and a frontline campaigner on climate awareness, road safety awareness, child health, etc. He has established a urban health centre for the benefit of slum dwelers. He has significant contribution in areas of weather interpretation and data acquisition, RCH and other motivational programmes on science popularisation.

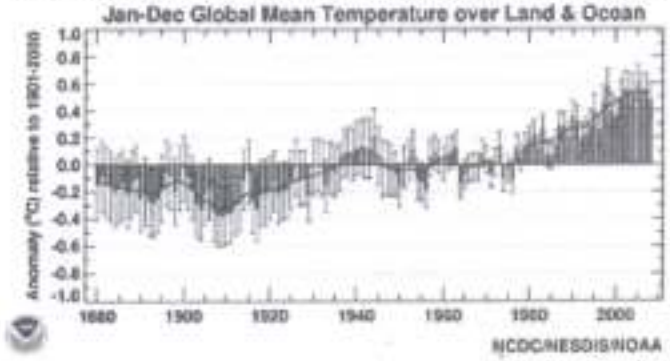
CLIMATE CHANGE IMPACT ON BIODIVERSITY OF ODISHA

Kishore Chandra Mohanty
Science Expert, Secondary Board of Education, Orissa

According to Harvard professor E. O. Wilson, a leader in the field, the current rate of extinction (the number of species lost each year) is between 1,000 and 10,000 times greater than the estimated rate of extinction before the evolution of humans. A species may be vulnerable to extinction for many reasons. Small populations can be wiped out by random local events, social dysfunction, or genetic deterioration. Species that cannot disperse well or that reproduce slowly are in danger. Those exploited by humans are particularly vulnerable because harvesting may drive populations too low, either inadvertently or intentionally. Species dependent on a threatened habitat will suffer the fate of that habitat. Species with large home ranges, such as elk, caribou, bears, and wolves, are also vulnerable because it is difficult for conservationists to protect a land area large enough to support a viable population. (A viable population has a 95 percent probability or better of surviving for more than 100 years). Let us examine some of the reasons of regional extinction to the boundaries of Odisha.

The data acquired from land stations and ships indicate that the global mean surface temperature warmed by about 0.9°F since 1880. These records indicate a near level trend in temperatures from 1880 to about 1910, a rise to 1945, a slight decline to about 1975, and further rise till 2006 and beyond. The Intergovernmental Panel on Climate Change (IPCC) concluded in 2007 that warming of the climate system is now "unequivocal," based on observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level (2007).

It is now concluded that most of the observed warming in global average surface temperature that has occurred since the mid-20th century is very likely a result of human activities (IPCC, 207). During the first half of the last century, there was likely less human impact on the observed warming, and natural variations, such as changes in the amount of radiation received from the sun, likely played a more significant role.



Troposphoric temperature change for the period beginning in 1979 with the help of various satellites for the mid-troposphere showed rates of warming – ranging from 0.09°F per decade to 0.34°F per decade. Stratospheric Temperature Change

In the layer 9-14 miles above the Earth's surface has cooled. The cooling is consistent with observed stratospheric ozone depletion since ozone is a greenhouse gas and has a warming effect when present. It's also likely that increased greenhouse gas concentrations in the troposphere are contributing to cooling in the stratosphere as predicted by radiative theory.

We know why CO_2 is increasing now, and the direct radiative effects of CO_2 on climate have been known for more than 100 years. In the absence of human intervention CO_2 does rise and fall over time, due to exchanges of carbon among the biosphere, atmosphere, and ocean and, on the very longest timescales, the lithosphere (i.e. rocks, oil reservoirs, coal, carbonate rocks). The rates of those exchanges are now being completely overwhelmed by the rate at which we are extracting carbon from the latter set of reservoirs and converting it to atmospheric CO_2. No discovery made with ice cores is going to change those basic facts.

Impact of climate change in coastal Odisha:
The 480 km long coastal plane of Odisha is vulnerable to climatic stress. Odisha climate is always prone to adverse consequences such as:

- Irregular rainfall affecting agriculture
- Western Odisha is often attacked by drought while its cycle in every 5-6 years affects the entire state.
- Sudden voluminous rain during rainy season
- More frequent heat waves during summer
- Costal parts are affected by heavy flood, storm and cyclone

Flora of Gopalpur Sea Beach:
Located at 186 km from Bhubaneswar, in the Ganjam district of Orrisa, this exotic beach is a paradise for marine lovers. opalpur is located at 19°16'N 84°55'E / 19.27°N 84.92°E.[1] It has an average elevation of 1 metres (3 ft). Gopalpur-on-Sea is a beach and tourist attraction near Berhampur. It is about 15 km by road from the nearest town, Berhampur. It on the shore of the Bay of Bengal. Gopalpur also has an ancient, commercial port, now lying in ruins. From an obscure little fishing village, it became a prominent trading port during the days of British East India Company.

An ancient sea port, Gopalpur beach gives space to a lighthouse as a small reminder of the seagoing days. Marine and coastal ecology includes aquatic fauna and flora composed of a large number of species of bacteria, phytoplankton, zooplankton, benthonic organisms, coral, seaweed, shellfish, fish and other aquatic biota, terrestrial flora such as mangroves and wetlands. Loss of bottom habitat and fishery resources are also significant problems encountered in this beach area.

Chilka Lake:
Chilka lake is a brackish water lagoon, spread over Puri, Khurda and Ganjam of Odisha state. The lagoon hosts over 160 species of birds in the peak migratory season. Birds from as far as the Caspian Sea, Lake Baikal, Aral Sea and other remote parts of Russia, Kirghiz steppes of Mongolia, Central and southeast Asia, Ladakh and Himalayas come here. These birds travel 12,000 km, to reach Chilika River but because of hot season coming suddenly affects the sanctuary environment affecting bird flow. The Errawady Dolphin is now the great attraction of the lake at Satkosia. The Irrawaddy Dolphin (Orcaella brevirostris) is the flagship species of Chilika lake. Chilka is home to the only

known population of Irrawaddy dolphins in India and one of only two lagoons in the world that are home to this species. It is classified as Critically Endangered, in five of the six other places it is known to live. A small population of Bottlenose dolphins, also migrate into the lagoon from the sea.

Chandka Elephant Reserve:

Chandka elephnat reserve is located in Bhubaneswar. The wildlife found are the Elephants, the Sambar, the Bears, the Wild Dogs, the Pythons, the Pea Fowls and many more. The Chandaka Forest is unique in its kind and is extremely dense and captivating. It exhibits a flora that is different in different areas. Semi evergreen forests, coastal sal forest, planted teak scrub, moist kangada forest, canes, maha limbo, eupatorium scrub, thorny bamboo brakes, medicinal plants, few orchid species, bamboo plants, etc. constitute the flora of the reserve. The tree species like Belo, Kochila, Sunari, Karanja, Sidha, Kalicha, etc. add variety to the elephant reserve.

Bhitarkanika National Park:

The land of lush green mangroves, migrating birds and turtles, the menacing estuarine crocodiles, meandering water courses, tranquil surrounding intercepted by the chirping of birds and the ever embracing nature, entrails visitors from near and far off places to flock these unique places of tourist importance. Scientists, Scholars, Nature Lovers and Tourists have abundant food for thought and exploration. Bhitarkanika represents one of the finest creations ever. Bhitarkanika is a unique habitat of Mangrove Forests criss-crossed with numerous creeks and mud flats located in Kendrapara district of Orissa. One of the largest Mangrove Eco systems in India, Bhitarkanika is home to diverse flora and fauna. Bhitarkanika National Park is a prime habitat of leopard cat, fishing cat, jungle cat, hyena, wild boar, spotted deer, sambar, porcupine, dolphin, salt water crocodile including partially white crocodile, python, king cobra, water monitor lizards, terrapin, marine turtle, kingfisher, wood pecker, hornbill, bar headed geese, brahmany duck, pintail, white bellied sea eagle, tern, sea gull, waders and a large variety of resident and migratory birds.

Simplipal Reserve Forest:

The park is located in the Mayurbhanj district in Odisha. Simlipal elephant Reserve is an ecosystem complete with forest vegetation (mainly sal trees), fauna and the adjoining Santhal tribal settlements. The park is a treasure house of 1076 species of plants belonging to 102 families. 96 species of orchids have also been identified here. It has a mixed type of vegetation known as semi eb=ver green forests with with dry deciduous hill forest and high level sal trees. The grasslands and the savanna provide grazing grounds for the herbivores and hiding place to the carnivores. The forest boasts of innumerable medicinal and aromatic plants, which provide a source of earnings for the tribal people.

A total of 42 species of mammals, 242 species of birds and 30 species of reptiles have been recorded in Simlipal National Park. The major mammals include Tiger, Leopard, Asian elephant, Sambar, Barking deer, Gaur, Jungle cat, Wild boar, Chausingha (four horned antelope), Giant squirrel and Common langur. 231 species of birds nest in these forests. Red Junglefowl, Hill Mynah, Peacock, Alexandrine Parakeet, Crested Serpent Eagle are the commonly found bird. The Grey Hornbill, Indian Pied Hornbill, Malabar Pied Hornbill and Indian Trogon are also found in the reserve. Apart from the large number of mammals and bird species, the park has a sizeable population of reptiles, which includes snakes and turtles. The "Mugger Crocodile Management Programme" has helped the Mugger crocodile (*Crocodylus palustris*) to survive and flourish on the banks of Khairi river.

All the above mentioned information provide habitat for wildlife (endangered species). because the conservation biology help conserving wild ecosystems. The core of conservation biology is to preserve all levels of biodiversity. The Corridors also connect critical animal habitats. Public advocacy organization whose mission is to educate the public about the parks, protect park resources, improve park funding, and ensure the high quality of visitors' experiences etc. are to be promoted through positive support of funding by the Government. Wildlife conservation is so important to us because the most beautiful gift that God has given to nature embellishing the natural beauty by their unique way of existence. But due the growing impact of deforestation, animal lovers are making continuous efforts to save the endangered species as well as those who are on the verge of extinction and save the world from loosing its green heritage.

The author is a dedicated nature lover and cares for biodiversity conservation besides organizing contemporary scientific campaigns, awareness camps, exhibitions, floral preservations and a pioneer co-ordinator in scientific programmes for the state.

HOW PROTECTIVE IS OZONE TO CLIMATE CHANGE THREAT

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Ozone is a pale blue gas, slightly soluble in water and much more soluble in inert non-polar solvents such as carbon tetrachloride or fluorocarbons, where it forms a blue solution. Ozone (O_3), or trioxygen, is a triatomic molecule, consisting of three oxygen atoms. It is much less stable than the diatomic O_2 that we breath. Ozone in the lower atmosphere (Troposphere)is an air pollutant with harmful effects on the respiratory systems of animals and will burn sensitive plants; however, the ozone layer in the upper atmosphere (Stratosphere)is beneficial, preventing potentially damaging ultraviolet light from reaching the Earth's surface. Ozone is present in low concentrations throughout the atmosphere. It has many industrial and consumer applications.

Evolution of the Ozone layer:
Early planet history tells us that there was initially

- no ozone present
- UV light directly hit planet's surface
- Oceans provided only refuge from UV radiation

Gases	Fraction of air
Constant gases	
Nitrogen, N_2	78.08%
Oxygen, O_2	20.95%
Argon, Ar	0.93%
Neon, Ne	0.0018%
Helium, He	0.0005%
Krypton, Kr	0.00011%
Xenon, Xe	0.000009%
Variable gases	
Water vapor, H_2O	4.0% (maximum, in the tropics)
	0.00001% (minimum, at the South Pole)
Carbon dioxide, CO_2	0.0365% (increasing ~0.4% per year)
Methane, CH_4	~0.00018% (increases due to agriculture)
Hydrogen, H_2	~0.00006%
Nitrous oxide, N_2O	~0.00003%
Carbon monoxide, CO	~0.000009%
Ozone, O_3	~0.000001% - 0.0004%
Fluorocarbon 12, CF_2Cl_2	~0.00000005%

Characteristics of Ozone:

- Ozone is highly corrosive and toxic and is used as a disinfectant.
- It can be found in small concentrations in the troposphere where it is considered a pollutant.
- It is thinnest around the equator and denser at the poles.

It is measured in Dobsum units: Millimeters Total Ozone is a measure of the total column amount above us which is measured in Dobson Units. If we bring all of the ozone above us down to the Earth's surface the thickness would be about 3 millimeters (~0.1 inches) = 300 Dobson Units (approximately the global average)
100 Dobson Units = 1 millimeter in thickness. The Dobson Unit is a convenient unit of measurement for total column ozone.

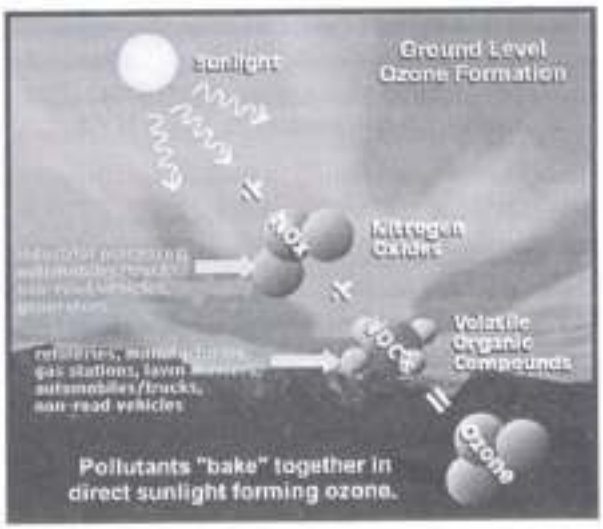
Properties of Ozone:

- Ozone is very highly reactive and will combine with other substances easily.
- Near the earth's surface, these reactions cause rubber to crack and damage people's lung tissues.
- Inhaling ozone can damage the respiratory tract, which enables us to breathe.
- Ozone at ground level

- Is smog, a pollution that is harmful to breath
- Ozone also stunts plant growth. That hurts farmers, agriculture, and our economy.

Ozone as a greenhouse gas:
Although ozone was present at ground level before the industral revolution, peak concentrations are now far higher than the pre-industrial levels, and even background concentrations well away from sources of pollution are substantially higher. This increase in ozone is of further concern because ozone present in the upper troposphere acts as a greenhouse gas, absorbing some of the infrared energy emitted by the earth. Quantifying the greenhouse gas potency of ozone is difficult because it is not present in uniform concentrations across the globe. However, the most widely accepted scientific assessments relating to climate change (e.g. the IPCC Third Assessment Report) suggest that the radiative forcing of tropospheric ozone is about 25% than that of carbon dioxide.

Harmful Ozone formation: It is known as ground level ozone formation. At a particular range of incident radiation, the sunlight combines with nitrogen oxides and further volatile organic compounds to form Ozone. Industrial processes, automobile exhausts, generators etc emit nitrogen oxide that reacts with sunlight to form volatile organic compounds (VOC) emitted from refineries, gas stations, automobiles etc. These pollutants bake together under direct sunlight to form Bad Ozone (10% of total Ozone).



Good Ozone Located in stratosphere that absorbs UV radiation and protects life on Earth.

Formation Process:
1. Oxygen molecules are photolyzed yielding 2 oxygen atomes
2. Oxygen and Ozone atoms are continuously inter-converted as solar UV breaks Ozone and Oxygen atoms reacts with another Oxygen atom (FAST)
3. Ozone is lost by the reaction of the Oxygen atom or with the Ozone molecule each other, or some other trace gas such as chlorine (SLOW).

This inter-conversion process converts UV radiation into thermal energy heating the stratosphere (90% of total Ozone).
However, there is equilibrium between creation and break down of Ozone.

Ozone Facts:
- UVc - 100% absorption
- UVb - 90% absorption
- UVc - 50% absorption and scattering

What is the "ozone hole?" When did it first appear? How does it form ?

The ozone hole is the region over Antarctica with total ozone 220 Dobson Units or lower. (The avg total column ozone in the atmosphere is about 300 DU.)

Ozone depleting substances:

- Chlorofluorocarbons (CFCs) were used in *air conditioning/cooling units, as aerosol spray propellants* prior to the 1980s, and in the cleaning processes of delicate electronic equipment. Once released into the atmosphere, chlorofluorocarbons are bombarded and destroyed by ultraviolet rays. In the process chlorine is released to destroy the ozone molecules
- It is calculated that a CFC molecule takes an average of 15 years to go from the ground level up to the upper atmosphere, and it can stay there for about a century, destroying up to 100,000 ozone molecules during that time.
- It is advised that CFC may be replaced by HFC: Long term replacement of CFCs and HCFCs is advisable because they absorb thermal IR radiation. They contribute to global warming. One atmospheric degradation pathway can produce trifluoroacetic acid (TFA).

Special Antarctic Polar Winter:

Special Antarctic Polar Winter Conditions [Polar Stratospheric Cloud (PSC) Formation]. Heterogeneous reactions (PSC surface reactions) convert relatively inactive forms of chlorine [e.g., HCl, ClONO2] to *photochemically active* forms [e.g., Cl2, HOCl, ClNO2].

Significance of UV light:

- UV light can have beneficial effects such as it stimulates the transformation dietary steroids into Vit D (calciferol)
- UV light is used to sterilise foods and medical equipment
- Insects use it to guide them to nectar sources in flowers
- UV light is high energy light
- When it strikes molecules it can cause them to beak into ions or free radicals
- The free radicals in turn damage large molecules such as proteins and DNA
- Damage to DNA causes mutations
- It is a mutagen and Mutations can lead to cancer
- UV-B has a direct effect on DNA as DNA absorbs UV light of 260nm
- The action of UV forms thymine dimers that can cause a gene mutation when the DNA replicates
- Damaging effects such as Sunburn
- Clouding of the cornea and formation of cataract
- Skin cancer (melanoma)
- Reduced rates of photosynthesis

Solutions for protecting Stratospheric Ozone:

- Stop producing CFCs
- properly recycle old CFCs
- Use safe alternatives
- Educate other governments for environmental policies

Solutions for minimizing Tropospheric Ozone:

- Car pool
- Mass transit
- Walking/biking
- Buy cars with better gas mileage
- Alternative cars/fuels
- Fill tanks in the morning or at night

Montreal Protocol:

The Montreal Protocol on substances to prevent depletion the Ozone Layer is an international treaty designed to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion. The treaty entered into force on January 1, 1989. Due to its widespread adoption and implementation it has been hailed as an example of exceptional international cooperation "Perhaps the single most successful international agreement to date...".

The author is a young promising environment activist fostering several bio-conservation projects like Banayan tree conservation project etc. He is in the teaching faculty of the Nano-Biotechnology Institut and a dedicated conservationist. E-mail: abhisek.bluejay@gmail.com

SOIL BIOLOGICAL HEALTH & ITS FERTILITY PROPERTIES

Mirja Jaynul Baig
Sr. Scientist, Central Rice Research Institute, Cuttack

Soils are alive! A variety of soil organisms live in the soil. These include bacteria, fungi, microarthropods, nematodes, earthworms and insects. These organisms live on soil organic matter or other soil organisms and perform a number of vital processes in the soil. Other organisms are involved in transformation of inorganic molecules. Very few soil organisms are pests.

The role of soil organisms in soil fertility may involve the following:

- helping soil to form from original parent rock material,
- contributing to the aggregation of soil particles,
- enhancing cycling of nutrients,
- transforming nutrients from one form to another,
- assisting plants to obtain nutrients from soil,
- degrading toxic substances in soil,
- causing disease in plants,
- minimizing disease in plants,
- assisting or hindering water penetration into soil.

Soil chemistry is concerned with the availability of elements for plant uptake as well as the presence in soil of elements and chemical compounds that might be present at levels that are detrimental to plants and soil organisms. Some elements in the soil are nutrients and are essential for plant growth. Other elements are not essential and may be toxic to plants. The availability of elements for plant uptake is affected by soil pH and reactions of the elements with soil particles and organic matter.

Soil chemical fertility is affected by:

- composition and parent material of the soil,
- soil pH,
- element adsorption to clay surfaces and organic matter,
- soil salinity.

Basically a soil is composed of 50% solid and rest porespace. The solid portion of soil holds organic matter and inorganic (mineral) matter. The porespace contains gas and or water. Four components make up soil such as i) Organic matter (0.5 to 5.0%), Mineral matter 45 to 50%, Solution 25% and Gas 25%. For easy understanding soil organic matter is considered as residue from decaying plant material in soil at different stages of decomposition. Mineral matter contains clay, slit and sand. Solution part is the dissolved salts in soil water. The gaseous portion contains Nitrogen (79%), Oxygen (20%), Carbon dioxide (0.5%) and other gases (0.5%).

However, the soil is a living body. For example, the organisms in 1 gram soil contains: >100,000,000 bacterial cells; >11,000 species of bacteria; also fungi and larger animals.

Soil Animals:

Termite

Pseudoscorpion

Earthworm

Centepede

Soil Mesofauna:

Mites

Nematodes

Springtail

Soil mesofauna are important for 1) Residue decomposition, 2) Predation and 3) Pathogenesis.

Soil Microorganisms:

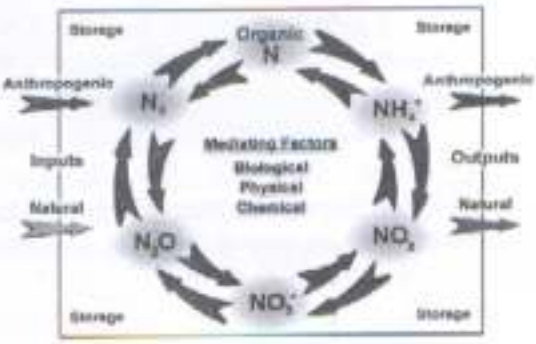
Fungi

Bacteria

Fungi

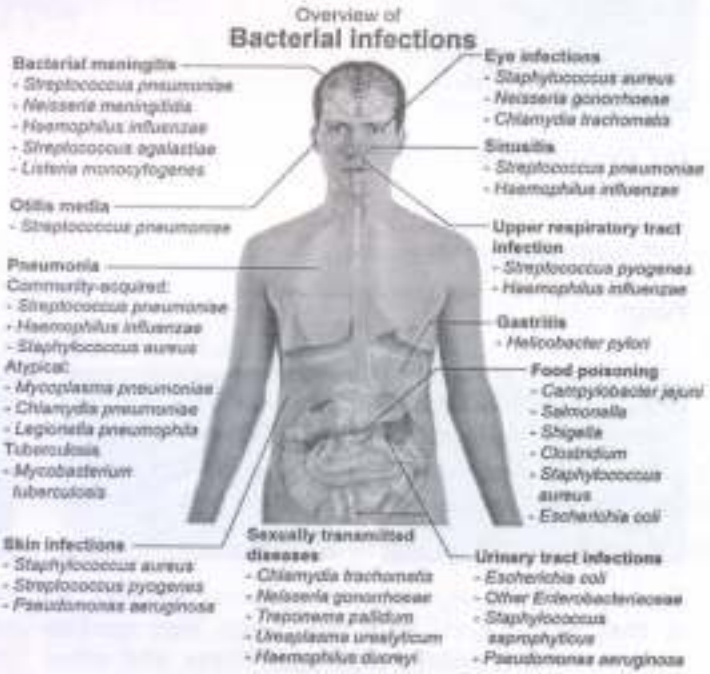
Fungi, which is separate from plants, animals, and bacteria. One major difference is that fungal cells have cell walls that contain chitin, unlike the cell walls of plants, which contain cellulose. These and other differences show that the fungi form a single group of related organisms, named the *Eumycota* The fungi could be of filamentous growth as well as they are functionally very critical. They can be found associated with wood known as mycorryhzal association (myco=fungus and rhiza means root). The fungus can exist in symbiotic form too. These mycorryhzal roots help the host plant in taking up soil phosphate, an important nutrient.

Bacteria; *singular*: **bacterium** are a large domain of single-celled, prokaryote microorganisms. Typically a few micrometers in length, bacteria have a wide range of shapes, ranging from speheres to rods and spirals. Bacteria are ubiquitous in every habitat on Earth, growing in soil, water, and deep in the crusts, as well as in organic matter and the live bodies of plants and animals. There are typically 40 million bacterial cells in a gram of soil and a million bacterial cells in



a millilitre of fresh water; in all, there are approximately five nonillion (5×10^{30}) bacteria on Earth, forming a biomass on Earth, which exceeds that of all plants and animals. Bacteria are vital in recycling nutrients such as the nitrogen fixation from the air and putrefication. However, most bacteria have not been characterised.

Although bacteria are often mistakenly associated only with disease, bacteria also perform useful functions. Bacteria are part of chemical cycles during which they release essential elements such as carbon and nitrogen for recycling. Bacteria decompose dead and decaying organic matter, assist animal digestion of food, and produce chemicals such as ethyl alcohol, butyl alcohol, acetic acid, and acetone. Bacteria also aid in the production of food products such as cheese, butter, sauerkraut, coffee, wine, and cocoa. Bacteria can be an integral part of the manufacture of silk, cotton, and rubber. Bacteria synthesize certain antibiotics. Bacteria that can digest and dissolve hydrocarbons are used to clean up oil spills



Disease-causing bacteria are parasites since they benefit at the expense of the host. Referred to as pathogens, these harmful bacteria release toxins or poisons that interfere with some function of the host's body. Examples of more common infectious diseases caused by bacteria include strep throat, tuberculosis, typhoid fever and tooth decay. Bacteria also cause sexually transmitted diseases, such as syphilis and gonorrhea. Bacterial diseases are transmitted from host to host through various means, such as direct contact, food, water, animal bites, contaminated objects, and droplets in the air. The body's immune system is capable of overcoming some bacterial diseases, but the control of bacterial diseases requires preventing transmission, using vaccines, and administering antibiotics (medications that inhibit the synthesis of a functioning cell wall in bacteria, particularly in gram-positive species.

HEALTHY SOIL

- It helps bind water and release when necessary
- It helps in growth of root and ramification
- It brings balance in growth of micro-organisms and normally never disturbs the quality of environment thereby ensures health of both plant and microorganisms
- It helps in increasing agricultural productivity
- It harnesses the growth of soil organisms as well as all living beings

SOIL PROPERTIES:

- The properties of soil is always specific to a region
- To promote microbial growth and improve environment
- To safeguard health of plants and living being so that the qualities of air, water and environment is well maintained

It should be our onus to help soil to provide us the basic needs to sustain life on this planet.

The indicator of good soil is four fold such as good organic environment, good inorganic environment, good chemical environment and finally good organic content of the soil.

Thus, there should be integrated approach to sustain the soil health to ensure us higher agricultural productivity, to ensure food security and also be reminded that if we do not adhere to UNO's recommendations there will be eventual soil derogation leading to disaster.

We have to take constant care of the soil health because, soil erosion is a detrimental process that happens due to water (flood, land slide, deforestation) and air (pollution, high CO_2 and other green house gases).

IDEAL AGRICULTURAL PRACTICES:

- To ensure and increase the organic content of the soil
- To adopt good agricultural practices those promise the microbe environment
- Soil conservation
- To decrease the sodicity and acidity of the soil
- To test the soil periodically to observe soil quality and make up deficits
- To promote vermicompost
- Cover the soil with black plastic sheet to increase longevity of soil quality
- Drip and sprinkler irrigation
- Crop stand through row and line planting

REMEDIAL MEASURES TO ENCOUNTER SOIL ACIDITY:

About 12 million hectares of land in our country perpetually suffer from acidity (pH remaining below 5.5) resulting in poor productivity. In these problematic soils, we can ameliorate the soil acidity by adding lime and growing pulses as well as oil crops. By this practice, we can reduce application of fertilizer by 50% or more.

Strengthening the soil testing laboratories is another importance of priority. We have only 7 million soil testing labs whereas we presently require more than 120 million test labs to cater to the requirement of different regions. There should be ready reckon map on all India basis for appraisal, assessment and adopt recommended practice for ideal amelioration. A health card for each soil sample be prepared which should be updated as per amelioration from time to time. The Indian Council of Agricultural Research (ICAR), New Delhi are telecasting on line recommendations for various soil problems also in interactive mode which is quite beneficial for the farmers.

"Land, is not merely soil; it is a fountain of energy flowing through a circuit of soils, plants, and animals." Aldo Leopold

The author is a Sr. Scientist, CRRI and Treasure, Asscn. Of Rice Res. Workers (ARRW) an internationally acclaimed body in pursuit of Rice science. He is a frontline campaigner on climate change issues and has conducted several national seminars on changing climate.

Glimpses on Women & Child Welfare Society

The Women & Child Welfare Society, over the years of unstinted endeavour, strive and struggle has not only made a niche for its prominence but also has gained distrinct status and reputation for the following areas of involvement.

- PROBE - Orissa Programme
- Education
- Health & Sanitation
- Child Rights
- Road Safety Awareness & Education
- Science & Technology
- Environment Protection
- Climate Change
- Petroleum Conservation
- Yoga & Naturopathy
- Women Empowerement
- Human Rights
- Consumer Rights
- National Integration & Communal Harmony

BIODIVERSITY AND ITS CONSERVATION

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According to ecologists, without biodiversity, we will not survive. It supports many basic natural services for humans, such as fresh water, fertile soil and clean air that help pollinate our flowers and crops, clean up our waste and put food on the table to eat. Biodiversity refers to the numbers, variety and variability of living organisms and ecosystem. It includes all terrestrial, marine and other aquatic organisms covering diversity within species, between species as well as variations among ecosystems.

Threats to Biodiversity: Habitat loss, Habitat fragmentation, Edge effect, Habitat degradation, Water pollution, Land pollution and Extinction of exotic species are some of the prominent threats. In the process of evolution, we have already experienced 5 Mass Extinctions such as,
1) End Ordovician, 2) Late Devonian, 3) End Permian, 4) End Triassic and 5)End Cretaceous. Now, we are moving towards 6th Mass Extinction named as Green Revolution which is essential but let us examine what it does to us: It rapidly degrades soil, causes greater propensity for pests and diseases and decrease in water table, thus at the base is the loss of Biodiversity. Let us know some of the mass extinctions mentioned earlier. They are:

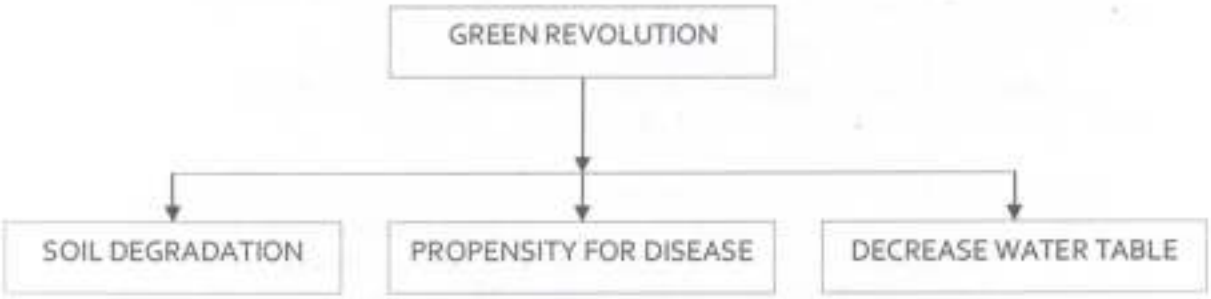
1) End ORDOVICIAN: The Ordovician period began approximately 490 million years ago. At this time, the area north of the tropics was almost entirely ocean, and most of the world's land was collected into the southern super-continent Gondwana. Throughout the Ordovician, Gondwana shifted towards the South Pole and much of it was submerged underwater. The Ordovician is best known for the presence of its diverse marine invertebrates and conodonts (early vertebrates). From the early to middle Ordovician, the earth experienced a milder climate in which the weather was warm and the atmosphere contained a lot of moisture. However, when Gondwana finally settled on the South Pole during the Late Ordovician, massive glaciers formed causing shallow seas to drain and sea levels to drop. This likely caused the mass extinctions that characterize the end of the Ordovician, in which 60% of all marine invertebrate genera and 25% of all families went extinct.
2) Late DEVONIAN (417 to 354 million years ago): Also during the Devonian, two major animal groups colonized the land. The first tetrapods, or land-living vertebrates, appeared during the Devonian, as did the first terrestrial arthopods, including wingless insects. During the Devonian, there were three major continental masses such as South America, Africa, Antarctica, India, and Australia dominating the southern hemisphere.
3) PERMIAN: The Permian continued from 290 to 248 million years, the last phase of Paleozoic era. This extinction affected many groups of organisms in many different environments, but it affected marine communities the most by far,

causing the extinction of most of the marine invertebrates of the time. On land, a relatively smaller extinction of diapsids and synapsids cleared the way for other forms to dominate, and led to what has been called the "Age of Dinosaurs". Also, the great forests of fern-like plants shifted to gymnosperms, plants with their offspring enclosed within seeds. Modern conifers, the most familiar gymnosperms of today, first appear in the fossil record of the Permian. In all, the Permian was the last of the time for some organisms and a pivotal point for others, and life on earth was never the same again.

4) **END TRIASSIC**: The supercontinent of Pangea, mostly assembled by the Triassic, allowed land animals to migrate from the South Pole to the North Pole. Life began to rediversify after the great Permo-Triassic extinction and warm-water faunas spread across Tethys.

5) **CRETACEOUS**: (165 to 45 million years ago)The Cretaceous is usually noted for being the last portion of the "Age of Dinosaurs", but that does not mean that new kinds of dinosaurs did not appear then. It is during the Cretaceous that the first ceratopsian and pachycepalosaurid dinosaurs appeared. Also during this time, we find the first fossils of many insect groups, modern mammal and bird groups, and the first flowering plants. The end of the Cretaceous brought the end of many previously successful and diverse groups of organisms, such as non-avian dinosaurs and ammonites. The Cretaceous was thus the time in which life as it now exists on Earth came together.

Then came the Green Revolution at the cost of biodiversity:



Diversity Factors:

- Habitat stress
- Geographical isolation
- Dominance by one species
- Availability of ecological niches
- Geological history

Importance of Biodiversity:

Biodiversity has contributed in many ways to the development of human culture, and, in turn, human communities have played a major role in shaping the diversity of nature at the genetic, species, and ecological levels. Among the important roles, it is worth mentioning Ecological, Economical and Scientific roles of biodiversity.

Causes: At least 40 per cent of the world's economy and 80 per cent of the needs of the poor are derived from biological resources. In addition, the richer the diversity of life, the greater the opportunity for medical discoveries, economic development, and adaptive responses to such new challenges as climate change.

Habitat & Degradation:

- Destruction of biodiversity rich areas like tropical forests.
- Destruction of Coral reefs and Wetlands.
- Ploughing of grasslands.
- Aquatic ecosystem is threatened.
- Pollution of freshwater streams, lakes, and marine habitats.
- Over-exploitation of resources.
- Construction of large dams disturbing the jungle, inducing migration etc.
- Commercial hunting and poaching.

BIODIVERSITY CONSERVATION IN ODISHA:

- Project Elephant
- Project Tiger
- Crocodile Conservation
- Sea Turtle Conservation
- Blackbuck Conservation
- Similipal Biosphere Reserve
- Nandan Kannan
- Lake Chilika
- Bhitar Kanika
- Project Gandhamardan

More than 10% of Odisha's plant species are under threat while more than 50 medicinal plants have disappeared in recent decades. About 10% of flowering plants, 20% of mammals and 5% of the birds are threatened. Its impact is tremendous such as 1) Increased vulnerability of species extinction, 2) Ecological imbalance, 3) Reduced sources of food, structural materials, medicinal and genetic resources and 4) Cost increase to the society.

RESPONSIBILITY AS A CITIZEN OF ODISHA:

1. Preserve and emulate Seed Banks, 2) Apiculture, 3) Developing low cost animal house, 4) Making of leaf zoos, 5) Conserving termitia in the vicinity, 6) Microbial diversity by conservation and *in situ* culture, 7) Fungal culture, 8) Paramaecim culture, 9) Animal culture (Drosophila), 10)Compost pits, 11) Establishing mini meteorological stations, 12) Solid waste management models 13) Study of soil fauna in school campus and other natural ambience, 14) soil health evaluation by assessing earthworm population, 15) Water conservation in school campus using pitcher irrigation and water health studies 16) Establishing an aquarium, 17) solid waste management practices, 18) Local septic tanks and sewerage systems, 19) clean sullage, 20) awareness campaigns etc.

CONCERN OF THE STATE:

The state has been facing challenges on account of rapid deforestation and loss of valuable wildlife. Making Biotechnology as a premier precision tool, we can shape our forest and wildlife resources for creation of wealth & ensuring social justice. Some 50 years ago, the first biotechnological intervention, Artificial Insemination (where semen from a superior male could be used to inseminate a large number of females), was introduced, which emerged as a new force in animal breeding. Genetic material from high vigor animals, in form of semen and ova can be stored and used as per requirement. Cryopreservation where embryos are dehydrated with the help of a "cryoprotectant" and slowly cooled from 25 to -38^0 C. These acclimatized embryos can then be plunged into liquid Nitrogen(-196^0 C) and stored for posterity. Genetic counseling enables us to locate a healthy genetic pool as well as to locate mutations amongst a population and embryo sexing will allow us to produce animals of desired sex, viz, Peacocks, which are of more economic importance than Peahens. DNA finger printing where DNA is isolated from blood, semen or tissue samples and subjected to Southern Blotting &, the DNA hybridization with the help of specific DNA probes. These probes correspond to hypervariable minisatellites in DNA each made up of tandem repeats of short sequences.Theprobes hybridize to DNA to create a pattern unique to the individual.Hence the name DNA fingerprinting. Biomonitoring: The animals can be radio-tagged or GPS-tagged in order to monitor their movements, with the help of radio collars or transmitters inserted within the body or in form of a collar so that the exact location of the animals can be determined along with providing a knowledge on the behavioral pattern of the animals, their movements and their territories.

Floral conservation:

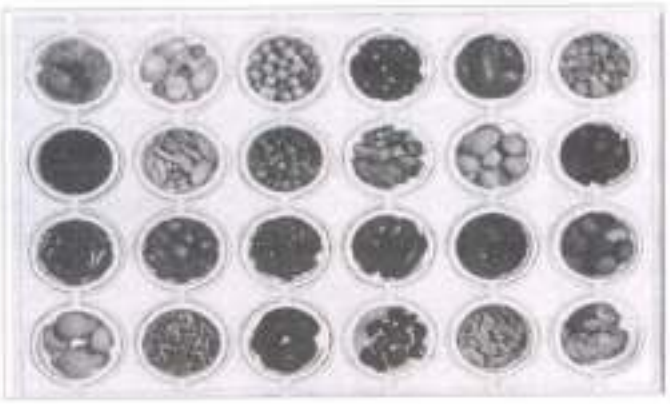
- Tissue Culture
- Clonal Propagation
- Hybridization + MAS
- Seed/ Grain Banks
- In-situ Conservation
- Ex-situ Conservation
- Cryo-Preservation
- Stress Tolerant varieties/cultivars

Quoting Dr. Swaminathan, "Orissa is a mega biodiversity area, rich in hydro-diversity. Like, the Koraput region is one of the centres of origin of rice and Bhitar kanika is one of the richest in mangroves. So it is timely intended to create awareness among the people on the importance of biodiversity conservation for our food, livelihood and human security," Hence Biodiversity Conservation will require:

- ❖ Formation of a State Biodiversity Board
- ❖ Financial resources,
- ❖ Infrastructure for basic & applied research
- ❖ Skilled manpower
- ❖ Passion for wildlife & forests and;
- ❖ A Herculean effort from the community.

At the start of the twenty-first century, it is of dire necessity that prominent organizations in the field of conservation biology come together bringing together a wide range of interested people, including resource managers, public and private

conservation workers, and students and educators from around the world to study—and take action to solve—the problems associated with protecting biological diversity. Because the goals and purposes of conservation biology are political in addition to scientific, research in the field typically is linked to an explicit ecological agenda. Conservation biology as a "crisis discipline," therefore, it is sometimes necessary to make tactical decisions. Conservation biologists include researchers and



managers from fields as varied as ecology, genetics, evolution, biogeography, wildlife biology, forestry, captive species breeding, and restoration ecology. Scientists hope that by studying why species become extinct, they can improve the management of natural areas and endangered species in ways that will prevent further extinctions.

Nursery raising and Seed Bank

Apiculture

Leaf Zoo

Banyan Tree Conservation

Termitaria

'For in the true nature of things, if we rightly consider, every green tree is far more glorious than if it were made of gold and silver'. Anonymous

The author is basically a prized Entomologist but a strong campaigner of Protection to Biodiversity in general while conservation of Banyan tree in particulalr. He is the Secretary of "Orissa Bigyan 'O' Bikash Parishad "a leading NGO of the state.

DROUGHT AND CLIMATE CHANGE

Padmini Swain
Principal Scientist,
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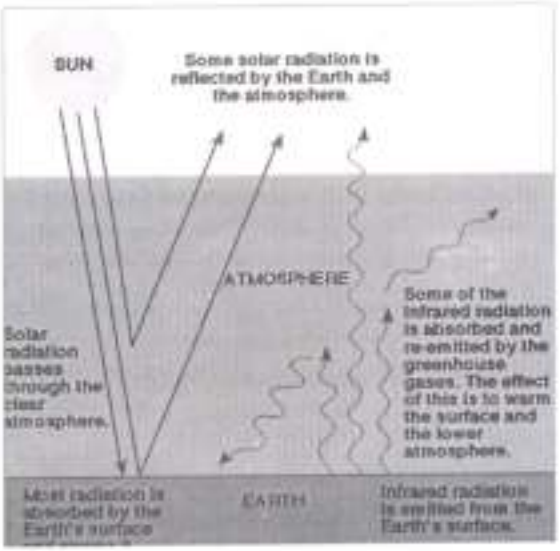
The behavior of the summer monsoon has significant implications for the economy and livelihoods in India, particularly in the rural sector. More than 60 percent of cropland in India is rain fed. Droughts and floods have deep impacts on rural households, and significant budgetary implications for the government at all levels. The ability to generate reliable seasonal climate forecasts, tailored to specific policy and institutional contexts, could improve India's ability to manage climate risks and reduce these impacts.

A drought is defined as an extended period of abnormally dry weather that causes water shortages and crop damage. A drought starts when total rainfall is well below average for several months. Other signs of drought include: unusually low river flows, low groundwater and reservoir levels, very dry soil, reduced crop yields or even crop failure, and algae blooms in reservoirs and lakes. Groundwater is not replenished because not enough rain is falling to wet the soil's entire surface area and to be absorbed properly. Crop production will be lower than usual; trees may die. Wildfires spring up; lack of irrigation can lead to famine and disease. Sociological consequences of drought range from social unrest to relocation of populations to war.

Greenhouse Effect:

The Greenhouse Effect is a naturally occurring phenomenon necessary to sustain life on earth. In a greenhouse, solar radiation passes through a mostly transparent piece of glass or plastic and warms the inside air, surface, and plants. As the temperature increases inside the greenhouse, the interior of the greenhouse radiates energy back to the outside and eventually a balance is reached.

The earth and its atmosphere simulates these greenhouse conditions. Short-wave radiation from the sun passes through the earth's atmosphere. Some of this radiation is reflected back into space, some of it is absorbed by the atmosphere, and some of it makes it to the earth's surface, where it is either reflected or absorbed. The earth, meanwhile, emits long-wave radiation toward space. Gases within the atmosphere absorb some of this long-


SUN
Some solar radiation is reflected by the Earth and the atmosphere.
ATMOSPHERE
Some of the infrared radiation is absorbed and re-emitted by the greenhouse gases. The effect of this is to warm the surface and the lower atmosphere.
Solar radiation passes through the clear atmosphere.
Most radiation is absorbed by the Earth's surface
EARTH
Infrared radiation is emitted from the Earth's surface.

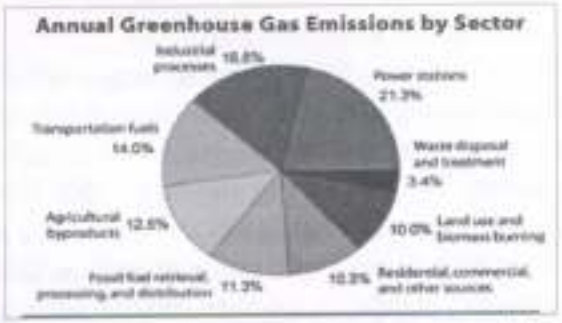
wave radiation and re-radiate it back to the surface. It is because of this greenhouse-like function of the atmosphere that the average global temperature of the earth is 15°C (59°F). Without the atmosphere and these gases, the average global temperature would be a frigid -18°C (0°F), and life would not be possible on earth. These gases are called greenhouse gases and include carbon dioxide (CO_2), water vapor (H_2O), methane (CH_4), nitrous oxide (N_2O), chloroflourocarbons (CFCs), and ozone (O_3).

The role of greenhouse gases in the atmosphere was first discovered during the 1800s. By 1896, Swedish scientist Svante Arrhenius was already calculating that the earth's surface temperature would increase by 5-6°C (9-10.8°F) with a doubling or tripling of the atmospheric CO_2 content. Such predictions received relatively little notice until the 1950s. In 1957, Roger Revelle and Hans Suess, scientists pointed out that the CO_2 would remain within the atmosphere for a very long time because of how slowly it is absorbed by the oceans. Since then there has been a growing acknowledgment of the increasing concentrations of not only CO_2 but also the other greenhouse gases and their potential impact on the global climate.

Public awareness of the Greenhouse Effect and the concern that the impact of increased emissions of CO_2, CH_4, N_2O, and CFCs would raise global temperatures grew in the 1980s. During an intense drought and heat wave in 1988, the media and several scientists speculated that the drought and heat wave affecting much of the United States were evidence of climate change. In hindsight, the 1988 drought was likely within the range of normal climate variability, but the attention was focused on the Greenhouse Effect.

Greenhouse Effect and Climate Change

We know with certainty that the concentrations of CO_2, CH_4, N_2O, and CFCs have increased as a result of recent human activity. Carbon dioxide is responsible for approximately half of the increase. Concentrations of CO_2 have been systematically monitored at the Mauna Loa Observatory in Hawaii since 1958. Scientists can determine the CO_2 concentrations from before 1958 using data collected from air bubbles within ice cores around the world. In 1750, levels of CO_2 were around 270 parts per million (ppm). By 1999, these levels were at 367 ppm, and they are increasing at 0.4% per year (IPCC, 2001). According to the congressional Office of Technology Assessment (OTA, 1993), 70-90% of the CO_2 added to the atmosphere is due to the burning of fossil fuels, and the rest is from deforestation. Methane, N_2O, and CFCs are also increasing at a similar rate. But because CFCs destroy ozone, the net warming effect from CFCs is approximately zero (but that leads to an entirely different problem: depletion of



stratospheric ozone). At these rates, it is estimated that the concentration of CO_2 will double preindustrial concentrations by at least 2100 (IPCC, 2001).

With the projected global temperature increase, some scientists think that the global hydrological cycle will also intensify. GCMs indicate that global precipitation could increase 7-15%. Meanwhile, global evapotranspiration could increase 5-10% (OTA, 1993). Thus, the combined impacts of increased temperature, precipitation, and evapotranspiration will affect snowmelt, runoff, and soil moisture conditions. The models generally show that precipitation will increase at high latitudes and decrease at low and mid-latitudes. Therefore, in mid-continent regions, evapotranspiration will be greater than precipitation and there will exist the potential for more severe, longer-lasting droughts in these areas. In addition, the increased temperatures alone will cause the water in the oceans to expand, causing an estimated sea level rise of 20 cm (8 in) by 2030 (OTA, 1993).

Water Resources and Climate Change

Although we don't know how climate change will affect regional water resources, it is clear that water resources are already stressed, independent of climate change, and any additional stress from climate change or increased variability will only intensify the competition for water resources. Current stresses on water resources around the globe include:

- growing populations
- increased competition for available water
- poor water quality
- environmental claims
- uncertain reserved water rights
- groundwater overdraft
- outmoded institutions
- aging urban water infrastructure

With a warmer climate, droughts and floods could become more frequent, severe, and longer-lasting. The potential increase in these hazards is a great concern given the stresses being placed on water resources and the high costs resulting from recent hazards. The drought of the late 1980s showed what the impacts might be if climate change leads to a change in the frequency and intensity of droughts across the country concerning human well being as well as food crops. The best advice to water resource managers regarding climate change is to start addressing current stresses on water supplies and build flexibility and robustness into any system. Flexibility helps to ensure a quick response to changing conditions, while robustness helps people prepare for and survive the worst conditions.

Climate change, drought, food and water crisis:

Intensification of drought, floods and cyclones is one of the predictable impacts of cli mate change and climate instability. The failure of monsoon in India and the

consequent drought, has impacted two thirds of India, especially the bread basket of India's fertile Gangetic plains. Bihar has had a 43 per cent rainfall deficit, Jharkhand of 47 per cent, Uttar Pradesh of 64 per cent, Haryana of 61 per cent, Punjab of 26 per cent, Himachal Pradesh of 63 per cent, Uttarakhand of 42 per cent averaging to 23% less rainfall.

India's food security rests on the monsoon. Monsoon failure and widespread drought implies a deepening of the water crisis. This year (2010), because of drought there will be reduced recharge. Since 1966, as a consequence of the introduction of the Green Revolution model of water intensive chemical farming, India has over exploited her groundwater, creating a water famine. According to reports, the rice production in the country would suffer a 10 million tonne decline. Also, the production of soyabean, cotton, sugar cane would suffer due to this drought. Few reports regarding the cause of the drought have been really alarming. The Inter-governmental Panel on Climate Change has seen some strong connection between the drought and the global warming. According to the chief of the panel, Rajendra Pachauri, the unusual hot winds have kept the monsoon rain away from a large part of India. And it is the same hot wind that is melting the ice of Himalayas causing flood in Bihar, West Bengal, Bangladesh and Assam.

Types of Drought:

Hydrological drought: Determined by water levels in the reservoirs - Depletion in amount of available water in water sheds, river systems and reservoirs.

Meteorological Drought: The average rainfall received < 200 mm to > 8000 mm.

The lowest rainfall receiving areas are Rajasthan, Gujarat, Western Uttar Pradesh, parts of Haryana and Punjab, and the central peninsular region of Kamataka, Maharashtra and Andhra Pradesh. The highest rainfall receiving regions are the North-east, Western Coastal regions, Eastern Madhya Pradesh, Chattisgarh, West Bengal, Jharkhand, Bihar and Orissa.

Agricultural Drought: Related to availability of water to crops typically seen after meteororlogical drought and before Hydrological drought when soil moisture becomes a problem, shortage in precipitation, changes in evapotranspiration, and reduced ground water level.

Drought physiology: Plants require water for evaporative cooling by Transpiration. Carbon gain and growth occurs only when plants transpire through open stomata. We need more carbon gain for every unit of water spent know as water use efficiency expressed in terms of biomass increase per unit of water loss from the system (transpiration, evapo-transpiration etc.) Varieties with long, thick roots are generally more drought resistant. The ability of root systems to provide for evapo-transpirational demand from deep soil moisture and capacity for osmotic adjustment are considered major drought resistance traits in rice.

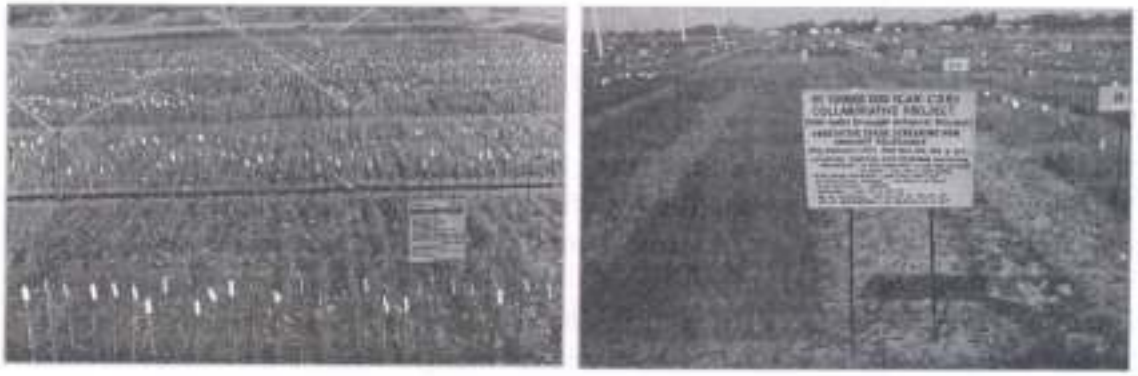
Effect of Drought on Rice crop in India:

Keeping population growth in view, the current level of production needs to grow steadily at 1.8 % a year. This is frightening to note when we consider that the rice production growth rate of 1975-1985 (3.2 %), which declined to 1.7 % during 1985-95, is declining further, to less than 1% during 2005.

Rice grown under various ecologies in India:

Ecology	Area in m. ha	Percentage
Irrigation	22.0	49.3
Rainfed Upland	6.0	13.5
Rainfed Lowland	14.4	32.3
Flood prone	2.2	4.9
Total	44.6	100

Out of 44.6 million ha area under rice in India, drought is one of the major abiotic constraints in around 8.0 million ha of rainfed upland and rainfed low-land situations. 18% of total rice area of India and 20% of Asia are drought prone. Drought is defined as depletion of precipitation over time and in India, the irregularities in South-west monsoon do result in moderate to severe drought in rainfed rice growing areas.



Drought screening in field at Central Rice Research Institute, Cuttack

Critical stages of drought injury to rice cop are tillering stage, panicle initiation, flowering and grain filling. However, drought during grain filling is extremely detrimental and hence known as terminal drought which affects the grain growth drastically affecting significant loss in productivity. Therefore, it becomes important to screen rice germplasm (collection of rice genetic material) with tolerance to drought which will serve as donors for future breeding programme, Thus varieties with long, thick roots are generally more drought resistant. The ability of root systems to provide for evapotranspirational demand from deep soil moisture and capacity for osmotic adjustment are considered major drought resistance traits in rice.

Promising drought adapted varieties are divided into two categories such as 1) High Yielding types: Rasi, Vandana, Annada, CR 143-2-2 and TN 1 and 2) Local varieties: Lalnakanda 41, Mtu 17, Salumpikit, Kalakeri, Suryamukhi and Blackgora. In one go, several thousand accession from the germplasm are screened at Central Rice Research Institute as well as at International Rice Research Institute, The Philippines.

Conclusion:

There are two options for the management of crops in water limiting environments: the agronomic and the genetic management. With the genetic management option drought-tolerant varieties, once developed, would be a low economic input technology that would be readily acceptable to resource-poor, rainfed, small land holding farmers. Development of this genetic management technology requires robust, reproducible, simple, and rapid field, pot, and laboratory screening methods for identification of traits of drought tolerance in germplasm, and incorporation of the same in high-yielding varieties using conventional and biotechnological tools.

Biodiversity and soils are the most effective carbon sinks. They also help adapt to climate change and drought by increasing soil organic matter which increases the moisture holding capacity of soil, and hence provides drought proofing of agriculture.

The author is an accomplished Scientist working on drought tolerance in rice and a pro-environmentalist advocating on awareness on climate change aspects and repercussions of water scarcity.

CONSERVATION OF FISH BIODIVERSITY

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Asia is the most densely populated region on Earth. Many rivers in this region are highly polluted and significant portions of their drainage basins and floodplains have been deforested or otherwise degraded. Fishes exhibit enormous diversity in size, shape, biology and in the habitats they occupy. The great majority comprises bony fishes, mainly teleosts. In addition, there are around 800 species of cartilaginous and 70 of jawless fishes (lampreys and hagfishes). It is believed that out of 4000 species of vertebrate recognised world over 22000 are fish species; of which 8411 are fresh water while 11650 are marine. As per the report more than 24500 fin fish species exist throughout the world. In India 2163 species of finfish have been recorded from upland cold, warm waters of the plain, brackish water and marine environment.

Importance of fish

a) High Protein Value; b) High nutritional value; c) Taste of food; d) High market value; e) High scope for culture and f) High Productivity

Some important fishes of Orissa

i *Mystus aor* (Hamilton)
Class: Actinopterygii
Order: *Siluriformes*
Family: *Bagridae*
Genus: *Mystus*

ii *Mystus vittatus* (Bloch)
Class: Actinopterygii
Order: Siluriformes
Family: Bagridae
Genus: *Mystus*.

iii *Rita rita* (Hamilton)
Class: Actinopterygii
Order: Siluriformes
Family: Bagridae
Genus: *Rita*

iv *Pangasius pangasisus* (Hamilton)
Class: Actinopterygii
Order: Siluriformes
Family: Pangasiidae
Genus: *Pangasius.*

vi *Amblypharyngodon mola* (Hamilton)
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Amblypharyngodon*

vii *Chela bachila* (Hamilton)
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: Chela

ix *Esomus danricus* (Hamilton)
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: Esomus

xii *Osteobrama cotio cotio* (Hamilton)
Class: Actinopterygii
Order: Cyprinoformes
Family: Cyprinidae
Genus: *Osteobrama*

xiii *Puntius gonionotus* (Bleeker)
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Puntius*

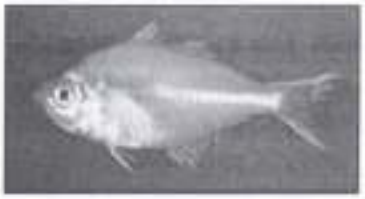
xix *Puntius sarana* (Hamilton)
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Puntius*

xx *Puntius sophore_* (Hamilton)
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Puntius*

xxi *Puntius stigma* (Day)
Class: *Actinopterygii*
Order: *Cypriniformes*
Family: *Cyprinidae*
Genus: *Puntius*

xxii *Trichogaster fasciatus* (Bloch and Schneider)
Class: Actinopterygii
Order: Perciformes
Family: Belontiidae
Genus: *Trichogaster*

xxiii *Chanda nama* (Hamilton)
Class: Actinopterygii
Order: Perciformes
Family: Ambassidae, Genus: *Chanda*



xxiv *Channa marulius* (Hamilton)
Class: Actinopterygii
Order: Perciformes
Family: Channidae
Genus: *Channa*

xxv *Channa striatus* (Bloch)
Class: Actinopterygii
Order: Perciformes
Family: Channidae
Genus: *Channa*

xxvi *Glossogobius gurius gurius* (Hamilton)
Class: Actinopterygii
Order: Perciformes
Family: Gobiidae
Genus: *Glossogobius*

xxvii *Nundus nundus* (Hamilton)
Class: Actinopterygii
Order: Perciformes
Family: Nandidae
Genus: *Nundus*

xxviii *Xenentodon cancila* (Hamilton)
Class: Actinopterygii
Order: Cyprinodontiformes
Family: Belonidae
Genus: *Xenentodon*

Why we conserve fish biodiversity

Due to factors such as human modifications to the environment, over exploitation, habitat loss, exotic species and others, aquatic biodiversity is greatly threatened. Ecosystems and species are important in sustaining human life and the health of the environment is disappearing at an alarming rate. In order to preserve these threatened areas and species for future generations, immediate action in the form of aquatic biodiversity conservation strategies are necessary. In general, aquatic conservation strategies should support sustainable development by protecting biological resources in ways that will preserve habitats and ecosystems. In order for biodiversity conservation to be effective, management measures must be broad based.

The five principal elements or tasks in the recovery programmes have been identified as

1. Habitat management, 2. Habitat development and maintenance, 3. Native fish stock, 4. Non native and sport fishing and 5. Research data management and monitoring

Hypotheses of fish biodiversity

1. **Biotic resistance** suggests that a high diversity of freshwater fish in the host ecosystem acts as a barrier to the establishment of non-native fish species populations.
2. **Biotic acceptance** postulates conversely that, for a given ecosystem, non-native species diversity follows that of native species because favourable ecological conditions for the latter are also suitable for the newly arrived species.
3. **Human activity** takes account of the different indicators at river-basin scale (gross domestic product, percentage of land that had been urbanised, population density), that can yield determination of the relation between anthropic pressure and non-native species diversity.

Conservation Strategies for Fish Biodiversity

The main goal in a conservation programme is to conserve the genetic diversity. The fish genetic resources can be conserved by protecting an ecosystem which is broad-based, on-

specific, cost effective and relatively simplistic in approach .It may aim in general or at specific species like endangered or threatened ones. This can be achieved through many mechanisms including *in situ* and *ex situ* methods

In-situ conservation: In situ conservation of fish as landraces and wild relatives is useful where genetic diversity exists and where wild forms are present. This is done through their maintenance within natural or man -made ecosystem in which they occur. The major advantages of insitu conservation to co-evolve with other forms, providing the breeders with a dynamic source of resistance that is lost in ex situ conservation and (ii) natural parks and biosphere reserves may provide less expensive protection for the wild relatives than ex situ measures.

Ranching: Stock enhancement through ranching is feasible only (i) if there is incomplete colonization of available carrying capacity. The successful induced spawning and larval rearing of endangered *Tenuolosa* (Hilsa) *Ilsha, Tor kkudree, Tor putitora, Labeo dussumieri, Ompok pabda ,Clarias dussumieri,Ompak malabaricus, Osteobrama belangeri, Notopterus chitala* have opened up the avenues of replenishment. In the 3 important lakes, Bhimtal, Naukuchiatal and Sattal of the Kumaon Himalayas, there are evidences of auto-stocking due to natural breeding of mahseer fingerlings in Ladhiya and Sharda rivers by NBFGR ,Lucknow, and National Research Centre on Cold water Fisheries (NRCCWF) Bimetal, has already been initiated .Ranching of the pond-reared fingerlings in Pama river of Kerala improved landings of the endangered *Labeo dussumieri*.

Conservation of aquaculture: Through probability of inbreeding in hatchery-bred seed normally cannot be ruled out, conservation aquaculture is gaining importance in rehabilitation programmes of endangered / threatened fishes.

Marine Reserve/Protected waters: A marine reserve is a defined space within the sea in which fishing is banned or other restrictions are placed in an effort to protect plants, animals, and habitats, ultimately conserving biodiversity. Marine reserves can also be used for educational purposes, recreation, and tourism as well as potentially increasing fisheries yields by enhancing the declining fish populations. Marine reserves are also very similar to marine protected areas, fishery reserves, sanctuaries, and parks.

Aquatic Diversity Management Areas (ADMAs): The creation of ADMAs, are a systematic management approach for watersheds, where the primary goal is to protect the aquatic biodiversity in a given area. ADMAs range from individual species protection acts to full-scale biodiversity oriented programs. The best way to properly manage ADMAs is to stop or greatly reduce all human activity contributing to habitat degradation in that area.

Bioregional Management: Bioregional management is a total ecosystem strategy, which regulates factors affecting aquatic biodiversity by balancing conservation, economic, and social needs within an area. This consists of both small-scale biosphere reserves and larger reserves. Biosphere reserves, generally small in scale, have a strong conservation focus, and

consist of one or more protected central habitats and surrounding buffer zones. In these bio conservation units, activities such as fishing, hunting, harvesting, and development activities are strictly limited.

Threatened or endangered species designations: Threatened species include organisms likely to become endangered if not properly protected. Endangered species are plants and animals that need protection in order to survive, as they are in immediate danger of becoming extinct. Once species are "listed," they become subject to national recovery programs and will be placed under international protection. Severe monetary penalties can occur if threatened and endangered species regulations are broken, and can even result in jail sentences.

Local watershed groups: Rivers and streams, regardless of their condition, often go unprotected since they often pass through more than one political jurisdiction, making it difficult to enforce conservation and management of resources. However, in recent years, the protection of lakes and small portions of watersheds organized by local watershed groups has helped this situation. For more information on how you can become involved in your watershed.

Freshwater Initiatives: The Nature Conservancy has instituted a program referred to as the Freshwater Initiative. The objective of the FWI is to significantly increase freshwater conservation within the country, through three strategies: watershed action, water science, and water lessons.

Research: Various organizations and conferences that research biodiversity and associated conservation strategies help to identify areas of future research analyze current trends in aquatic biodiversity, even conduct specialized studies.

Increase Public Awareness: Increasing public awareness is one of the most important ways to conserve aquatic biodiversity. This can be accomplished through educational programs, incentive programs, and volunteer monitoring programs. For example, the State of Delaware has an Adopt-a-Wetland Program designed increase public awareness as to the value and of wetlands and the need for conservation. The EPA developed a site with links to organizations that teach the public how to become involved in volunteer monitoring programs at

Restoration/Mitigation Efforts: Aquatic areas that have been damaged or suffered habitat loss or degradation can be restored. Even species populations that have suffered a decline can be targeted for restoration (e.g., Pacific Northwest salmon populations). Some management practices such as the establishment of riparian buffer zones and the restoration of natural flow patterns and discharge regimes are being applied to riverine areas. Recently, habitat restoration has also been performed in various areas to replace losses from dredging projects and in many wetland habitats.

Regulatory Measures: The Indian Fisheries Act of 1897 (modified in 1956) is a landmark in the conservation of fishes. Besides provision to and monitor gears, mesh size and observance of fishing or closed seasons, the Act also prohibits the use of explosives or poisons to indiscrimately kill fish in any water at present, the ministry of agriculture, Government of India is modifying the Indian Fisheries Act to incorporate all the relevant legal to conserve fish germplasm resource. This may include wastewater discharge regulations like NPDES or fishery conservation measures, fisheries management councils, even fishery bans. This creation of sustainable fisheries is largely completed through regulatory actions including the collection of the best scientific data available.

Local community actions: The demand for freshwater - and the threats to its health - originate from the actions of millions of people. To solve these challenges also requires actions of many. State and federal governments, and many local governments and public agencies, are already at work. So, too, are numerous citizen volunteers. Any individual can take steps to make healthy water a welcome part of everyday life. Learn how you can make a difference.

Ex situ conservation: In this measure, the threatened are conserved outside their natural habitats. The main pillars of ex situ conservation programme are (I) live gene bank and (II) gene bank with gamete and (III) gene bank with DNA.

What can we do to save fish?

- **Dispose of trash properly.** This will help reduce the amount of trash blown into the waterways or washed from storm drains into the sea. Light objects such as plastic bags can easily blow away. Never let it lay around outside. In the central North Pacific, researchers have found six pounds of broken, degraded plastic pieces plastic for every single pound of zooplankton. Plastic pollution negatively impacts trillions upon trillions of ocean inhabitants and ultimately humans.
- **Do not release balloons** into the air as they will eventually land somewhere as trash. Many balloons end up in the ocean where marine animals mistake them for food.
- **Cut rings of plastic six-pack holders** as this lowers the risk of fish and other forms of life getting entangled in them. Also snip the holders at home as sometimes dump truck loose trash on the way to the landfill.
- **Reduce** (most effective), **reuse** (effective), and **recycle** (still pretty effective and certainly better than throwing away). Look for alternative materials or avoid excessive packaging when deciding on purchases. Take tote bags to the store to shop and Tupperware to the restaurant to take home food.
- **Do not dispose any fluids** (paint, lawn debris, car fluids, trash) except for clean water down storm drains or roadways as it may end up in water courses and eventually in the sea. Also, maintain your car so that no oil and other fluids leak out. Use kitty litter and diapers to catch the fluids if you do have a leak.

- **Prevent soil and sediment from running into creeks.** If you clear vegetation, set appropriate erosion control materials in place and revegetate the area as quickly as possible with native plants.
- **Do not support dams** unless they are built in ways that allows for fish passage. Write letters to authorities to voice your opinion. Talk to people about it.
- **Participate in local beach, river or stream clean ups.**
- **Pick up whatever trash you can** even on days other than the International Coastal Cleanup Day. Don't be concerned with what people think of you. Instead be strong and set an example; and if someone asks you why you are doing that, you have an opportunity to educate them.
- **Fish your own fish with lines** where it is legal and make sure you have a fishing license if your country requires you to possess one. This helps the fisheries management.
- **Don't use lead weights for angling,** this is now illegal as lead is a toxic metal.
- **Discard hooks, nets, lines and weights responsibly** as they are a potential threat to wildlife.
- Stop **dynamite fishing** once and for all!

We can no longer see the continued loss of biodiversity as an issue separate from the core concerns of society: to tackle poverty, to improve the health, prosperity and security of present and future generations, and to deal with climate change. Each of those objectives is undermined by current trends in the state of our ecosystems, and each will be greatly strengthened if we finally give biodiversity the priority it deserves more particulalry the fish biodiversity that has been sustaining the ever greedy human being across the globe.

WATER SCARCITY AND GLOBAL WARMING

Sangram Keshari Nayak
Principal Investigator, RVPSP (Agrasar) Lecture Series
(DST, New Delhi)

Global warming is expected to account for about 20 percent of the global increase in water scarcity this century. It is predicted that global warming will alter precipitation patterns around the world, melt mountain glaciers, and worsen the extremes of droughts and floods. Global water consumption increased six fold in the last century - more than twice the rate of population growth - and will continue growing rapidly in coming decades. Yet readily available freshwater is a finite resource, equivalent to less than one percent of the water on Earth.

What's more, water and populations are unevenly distributed across the globe; arid and semi-arid regions receive only two percent of all surface runoff yet account for 40 percent of the global land area and house half of the world's poor. Finally, our existing freshwater resources are under heavy threat from overexploitation, pollution, and global warming. Given these trends, equitably providing adequate water resources for agriculture, industry and human consumption poses one of the greatest challenges of the 21st century.

As worldwide populations grow and become more affluent, the demand for food and water rises. At the same time, climate variability and change are making it difficult to provide water where and when it is needed. Floods destroy communities in one part of the world, while in another people trek miles every day just to get enough water to survive. Water scarcity is a pervasive problem and is one of the most difficult challenges we face in the 21st century.

Increasing Evidence of Water Scarcity Worldwide

The physical evidence of water scarcity can be found in increasing magnitude around the world, affecting rich and poor countries alike. Nearly three billion people live in water scarce conditions (over 40 percent of the world's population), and this situation could worsen if current growth trends continue. Water poverty include millions of deaths every year due to malnourishment and water-related disease, political conflict over scarce water resources, extinction of freshwater species, and degradation of aquatic ecosystems. Roughly half of all wetlands have already been lost and dams have seriously altered the flow of roughly 60 percent of the world's major river basins.

Fig. 1: Areas of Physical and Economic Water Scarcity [Source: UN-Water 2007]

Physical Water Scarcity

Water scarcity is not a factor of absolute quantity; it occurs frequently in both dry and moist climates. Rather, it is a relative concept comparing the availability of water

to actual use. Desert regions, for example, do not classify as water scarce if demand for water is low. However, scarcity may exist in water-abundant areas if there is heavy population pressure, excessive pollution, or unsustainable consumption levels. Together, these forms of physical water scarcity affect every continent and approximately one-fifth of the world population.

In the United States and Europe, the average individual uses between 200 and 600 liters of water per day, compared to the 20 liters deemed to be the minimum daily requirement for drinking, washing, cooking and sanitation. Such unsustainable consumption levels have led to localized areas of water scarcity and significantly altered freshwater ecosystems.

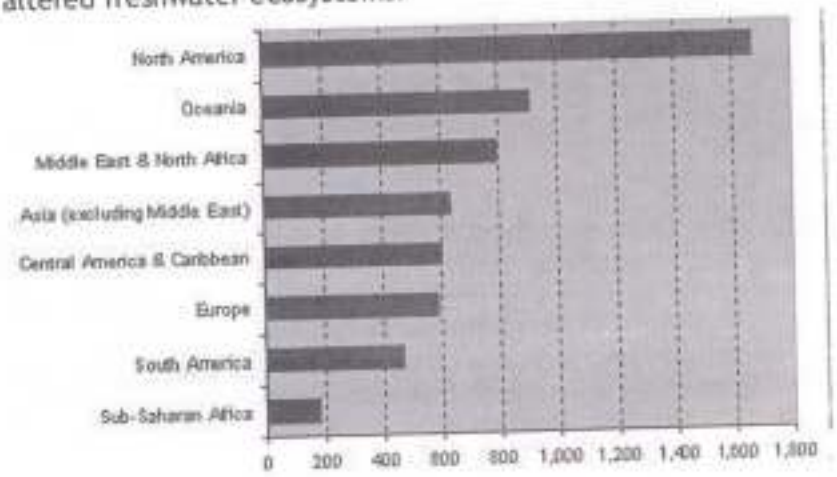


Fig. 2: Per Capita Water Use, 2000 (cubic meters per year) Source: Earth Trends

Economic Water Scarcity

On the other hand, economic water scarcity occurs when water resources are abundant relative to water use, but insufficient infrastructure or financial capacity prevents people from accessing the water they need. This dilemma plagues an additional 1.6 billion people worldwide, predominantly the rural poor and particularly in Africa. Slum dwellers, for example, typically pay five to 10 times more per unit of water than do people with piped water, and in rural households, women and children may spend the majority of their day fetching water from distant, and often unsafe, sources. The majority of the world's poorest people are smallholder farmers, most of whom rely on low-yield, rain-fed agriculture, and their livelihoods are constantly threatened by inconsistent precipitation and drought.

F ig 3: Poor households in developing countries spend higher portions of their income on water than families in industrialized nations. Source: UN-Water 2007

Water and Agriculture

Agriculture accounts for 70 percent of global water consumption and up to 95 percent of consumption in some developing countries. Irrigated agriculture, which accounts for only 20 percent of cultivated land but over 40 percent of the global harvest, has significant implications for the future of water availability and food security worldwide.

The world's population is projected to increase by 50 percent by 2050. With economic development and higher incomes around the world, per capita food consumption--and subsequently water consumption--will also rise. In particular, as more people in developing countries can afford diversified diets including meat and vegetables, agricultural water use will rise dramatically; it takes ten times more water to raise a kilogram of beef than a kilogram of wheat.

The Threat of Global Warming

Climate change is expected to account for about 20 percent of the global increase in water scarcity this century. The Intergovernmental Panel on Climate Change (IPCC) predicts that global warming will alter precipitation patterns around the world, melt mountain glaciers, and worsen the extremes of droughts and floods. If measures are not taken to mitigate climate change, a study by the UK Meteorological Office predicts that severe droughts now occurring once every 50 years could occur every other year by 2100.

Will There Be Enough Water?

With continued population growth, increased per capita consumption, and anticipated climate change, the global water situation appears bleak. Since water scarcity is a highly localized issue determined by regional climatic and demographic factors, a single solution will not solve all of the world's water scarcity problems. However, improved management, more water efficient technologies, and support for the world's most vulnerable countries and ecosystems will likely play leading roles. According to the UN-backed World Commission on Water, coping with water scarcity will require global investment of $100 billion per year. Willingness to invest this sum will be vital to the future of human well-being and economic development in all countries of the world.

Growing world population

One of the major problems for our future is the ever growing number of people living on this planet.

Population by country for 2007 and 2050 (ordered by population in 2050)

Country	2007	2050
India	1'129'866'154	1'807'878'574
China	1'321'851'888	1'424'161'948
United States	301'139'947	420'080'587
Indonesia	234'693'997	313'020'847
Pakistan	169'270'617	294'995'104
Bangladesh	150'448'339	279'955'405
Brazil	190'010'647	228'426'737

Global experiences in managing water crisis

It is alleged that the likelihood of conflict rises if the rate of change within the basin exceeds the capacity of institution to absorb that change. Although water crisis is closely related to regional tensions, history showed that acute conflicts over water are far less than the record of cooperation. The key lies in strong institutions and cooperation. The Indus River Commission and the Indus Water Treaty survived two wars between India and Pakistan despite their hostility, proving to be a successful mechanism in resolving conflicts by providing a framework for consultation inspection and exchange of data. The Mekong Committee has also functioned since 1957 and survived the Vietnam War. In contrast, regional instability results when there is an absence of institutions to co-operate in regional collaboration, like Egypt's plan for a high dam on the Nile.

However, there is currently no global institution in place for the management and management of trans-boundary water sources, and international co-operation has happened through ad hoc collaborations between agencies, like the Mekong Committee which was formed due to an alliance between UNICEF and the US Bureau of Reclamation. Formation of strong international institutions seems to be a way forward - they fuel early intervention and management, preventing the costly dispute in resolution process. Water crisis will continue to grow to extreme acute levels despite some of the brain storming solutions and thus, it is every individual to put up effort right now (or never) to conserve water for future.

The author is the former Principal Scientist, Central Rice Research Institute, Cuttack and front line campaigner on global warming,its repercussions and mitigation life style. He is the Principal Investigator of this RVPSP Agrasar Lecture Series supported and catalyzed by DST, New Delhi (Organised by WCWS, Cuttack).

DISTURBING FACTS ON CLIMATE CHANGE

Swayam Prakash Baral
Youth for Nation

Green House Gases (GHG)

Natural category:
Carbon dioxide (CO2)
Methane (CH4)
Nitrous oxide (N2O)
Hydrofluorocarbons (HFCs)

Man-made category:
Perfluorocarbons (PFCs)
Sulphur hexafluoride (SF6)

Is Methane more dangerous than CO2

- The heat absorbing potential of methane is about 33 times that of CO2
- But CO2 concentration in the atmosphere is much higher than that of methane that's why CO2 is considered as the most harmful GHG

Global Impacts:

- The largest glacier on Mount Kenya has lost 92% of its mass
- Sea levels have risen by 10 - 25 cm
- The thickness of sea ice in the arctic has decreased by 40%.

Climate change impact in India

- Rajasthan- Drought
- Rann of Kutch - sea level rise
- Mumbai-Salt water intrusion
- Kerala -Productivity of Forest Decreases
- Tamil Nadu-Coral bleaching
- Ganges - Sedimentation problem
- Sunderbans-Sea level rise
- Northwest India-reduction in rice yield

Current Environment scenario:

- Water Initiatives Orissa (WIO), claimed that while the global mean temperature rose by 0.5 degree celsius in the last 50 years, that of Orissa rose by 1 degree Celsius. In ten years average of highest recorded temperatures has increased by 4.4 to 6.6 degree Celsius and the average of lowest recorded temperatures has further decreased by 3 to 5.1 degree Celsius in various parts.
- Drop in ground water level
- The unseasonal rain and drought, in 2010 rain washed away rice cultivation
- Natural disasters - 1999 super cyclone

Coal based hydro-projects:

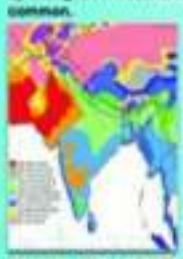
- Coal for power generation produces fly ash emission to the atmosphere.
- For 1MW of installed capacity approx, 1 to 1.5 acre of land is required for a period of 20 years to dump the dry ash.
- Large tracts of forest area are submerged in the reservoir area of the hydro project.

The author is a promising youth championing the war to prevent global warming. He represents one of the powerful NGOs of the state 'Youth for Nation'.

Different greenhouse gases have very different heat-trapping abilities. Some of them can even trap more heat than CO_2.
A molecule of methane produces more than 20 times thewarming of a molecule of CO_2. Nitrous oxide is 300 times more powerful than CO_2.Other gases, such as chlorofluorocarbons (which have been banned in much of the world because they also degrade the ozone layer), have heat-trapping potential thousands of times greater than CO_2. But because their concentrations are much low er than CO_2, none of these gases adds as much warmth to the atmosphere as CO_2 does.
In order to understand the effects of all the gases together, scientists tend to talk about all greenhouse gases in terms of the equivalent amount of CO_2. Since 1990, yearly emissions have gone up by about 6 billion metric tons of "carbon dioxide equivalent" worldwide, more than a 20 percent increase.

The carbon sink capacity of the world's agricultural and degraded soils is 50 to 66% of the historic carbon loss of 42 to 78 gigatons of carbon. The rate of soil organic carbon sequestration depends on soil texture and structure, rainfall temperature, farming system, and soil management. Strategies to increase the soil carbon pool include soil restoration and woodland regeneration, no-till farming,cover crops, nutrient management, manuring and sludge application, improved grazing, water conservation and harvesting, efficient irrigation, agroforestry practices, and growing energy crops on spare lands. An increase of 1 ton of soil carbon pool of degraded cropland soils may increase crop yield by 20 to 40 kilograms per hectare (kg/ha) for wheat, 10 to 20 kg/ha for maize, and 0.5 to 1 kg/ha for cowpeas. As well as enhancing food security,carbon sequestration has the potential to offset fossilfuel emissions by 0.4 to 1.2 gigatons of carbon per year, or5 to 15% of the global fossil-fuel emissions.

If the Earth gets hotter, than few events could happen:
Water expands when it's heated so sea levels could rise.
* Sea levels could also rise due to the melting of the glaciers and sea ice.
* Animals like polar bears - which live on the ice - might die out.
* There could be more floods, especially near the coast and rivers.
* Places that usually get lots of rain and snowfall might get hotter and drier.
* Lakes and rivers could dry up.
* There would be more droughts, making it harder to grow crops.
* Less water would be available.
* Some plants and animals might become extinct because they cannot cope with higher temperatures.
* Hurricanes, tornadoes and other storms which are caused by changes in heat and water evaporation may get more common.



Impact of Climate Change in India

GLACIERS :- Himalayan Glaciers will shrink from 500,000 Sq km to 100,000 Sq km. Prosf – the size of Gomukh

WATER :- Per Capita availability of water will shrink from 1,800 cubic m to 1,000 cubic m, making India a water-scarce Country by 2025

FOOD SECURITY :- Agriculture productivity is likely to shrink by 30 %. Substantial fall anticipated in production of rain-fed crops. How, it meets food demand of >1.5 billion people with a rise in rice productivity from 96 m. tonnes to 105 m. tonnes by 2015.

COME JOIN THE MOVEMENT TO AVOID FUEL WESTAGE

RAINFALL :- Winter rains will decrease (December, January and February), implying lesser storage and greater water stress.

COASTAL AREAS :- Estimated Sea level rise by 40 cm higher than today's level by the end of 21st century. It will flood the coastal areas in India and affect millions of people as environmental refugees.

ANT AND ANIMAL SPECIES :- 20-30 % of animal species assessed so far are at increased risk of extinction if global temperature exceeds 1.5 to 2.5 degrees Centigrade.

EALTH :- Water-borne diseases like Diarrohea and Cholera will rise in South Asia.

In Copenhagen, the Chairman of IPCC Dr. Rajendra Pachauri said:

"If we were to take action, the cost of mitigation are really much much lower than what anyone had anticipated. What's even more significant is the fact that there are huge core benefits in taking mitigation action."

Renewable Energy

Replace incandescent light bulbs (100W) with compact fluorescent bulbs (23 W). CFLs, prevents emission of 5000 kg of CO_2 and reduce your electricity bill by > Rs 5000 over life of 100 W incandescent bulb.

Become a smart water consumer. Install low-flow showerheads and you'll use half the water required. Then turn your hot water heater down to 120°F and save 50 percent.

Avoid moving by two or four wheel vehicles for marketing and short trips. Commute better by public transport. Stop engine at signals. Check tyre pressure, brake for fuel efficiency.

Plant trees as many as you can, the greatest remedy to global warming.

educe fossil fuel combustion:
educe cardio-respiratory deaths/hospitalisations from local pollution (esp. fine particulates).
ow-emission urban (public) transport system:
crease physical activity (walking, cycling) ? reduce ver-weight, improve lipid/endocrine profiles, increase social ntact and wellbeing.Road trauma should decline.
educe red (ruminant) meat consumption (livestock sector is jor source of GHG emissions, esp. methane)
educe risks of some diseases: large bowel cancer, east cancer; also heart disease (meat fat content).
ore energy-efficient housing
educe family costs, and (especially for lower-income useholds) reduce thermal stress – and debt-related mental ress.

THE ALARM BELLS WILL BE RINGING IN EVERY COUNTRY OF THE WORLD

Low Carbon Green Growth can provide win-win solutions for fostering sustainable development while mitigating and adapting to climate change. Countries within Asia and the Pacific, particularly South-East Asia, are already witness to the negative effects of climate change through increased temperatures and frequency and intensity of climatic events (e.g. tropical cyclones, floods and droughts).

- Some impacts from increasing temperatures are already happening.
- Ice is melting worldwide, especially at the Earth's poles. This includes mountain glaciers, ice sheets covering West Antarctica and Greenland, and Arctic sea ice.
- Researcher Bill Fraser has tracked the decline of the Adélie penguins on Antarctica, where their numbers have fallen from 32,000 breeding pairs to 11,000 in 30 years.
- Sea level rise became faster over the last century.
- Some butterflies, foxes, and alpine plants have moved farther north or to higher, cooler areas.
- Precipitation (rain and snowfall) has increased across the globe, on average.
- Spruce bark beetles have boomed in Alaska thanks to 20 years of warm summers. The insects have chewed up 4 million acres of spruce trees.
- Other effects could happen later this century, if warming continues.
- Sea levels are expected to rise between 7 and 23 inches (18 and 59 centimeters) by the end of the century, and continued melting of the poles could add between 4 and 8 inches (10 to 20 centimeters).
- Hurricanes and other storms are likely to become stronger.
- Species that depend on one another may become out of sync. For example, plants could bloom earlier than their pollinating insects become active.
- Floods and droughts will become more common. Rainfall in Ethiopia, where droughts are already common, could decline by 10 percent over the next 20 years.
- Less fresh water will be available. If the Quelccaya ice cap in Peru continues to melt at its current rate, it will be gone by 2100, leaving thousands of people who rely on it for drinking water and electricity without a source of either.
- Some diseases will spread, such as malaria carried by mosquitoes.
- Ecosystems will change—some species will move farther north or become more successful; others won't be able to move and could become extinct. Wildlife research scientist Marilyn Ontiveros has found that since the mid-1980s, with less ice on which to live and fish for food, polar bears have gotten considerably skinnier. Polar bear biologist Ian Stirling has found a similar pattern in Hudson Bay. He fears that if ice on disappears, the polar bears will as well.

Thanks

- Where was Coretta Scott King born?
- What did her parents do?
- Did she experience prejudice or injustice because of her race when she was a child?
- What kind of a student was she?
- What were her interests?
- Did she go to college? If so, where?

We simply must do everything we can in our power to slow down global warming before it is too late.